Walla Walla River Basin Fish Habitat Enhancement Project

Annual Report
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WALLA WALLA RIVER BASIN
FISH HABITAT ENHANCEMENT PROJECT

ANNUAL REPORT OF PROGRESS 2001
(February 1, 2001 to January 31, 2002)

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ABSTRACT

In 2001, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) Fisheries Habitat Program implemented stream habitat restoration and protection efforts in the Walla Walla River Basin with funding from Bonneville Power Administration (BPA). The objective of these efforts is to protect and restore habitat critical to the recovery of weak or reintroduced populations of salmonid fish. The CTUIR has currently enrolled six properties into this program: two on Couse Creek, two adjacent properties on Blue Creek, one on Patit Creek, and one property on the mainstem Walla Walla River. Since 1997, approximately 7 miles of critical salmonid habitat has been secured for restoration and protection under this project. Major accomplishments to date include the following:

- Secured approximately $250,000 in cost share
- Secured 7 easements
- Planted 30,000+ native plants
- Installed 50,000+ cuttings
- Seeded 18 acres to native grass

Pre and post-project monitoring efforts were included for all projects, incorporating methodologies from CTUIR's Draft Monitoring Plan. Basin-wide monitoring also included the deployment of 6 thermographs to collect summer stream temperatures.

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BACKGROUND

This project is funded to restore and protect habitat critical to the survival of salmonid fish in the Walla Walla River Basin. The project feels it is imperative to understand the historic condition of the floodplains, including the uplands and rivers of the basin prior to the dramatic decline of summer steelhead and extinction of salmon. By doing so, we can determine a desirable future condition for habitat restoration efforts.

The conditions we see today in the Walla Walla River Watershed reflect the land-use practices that have occurred in the basin throughout its history (United States Dept. of Agriculture, 1941). The earliest inhabitants of the Walla Walla River Basin included three Native American Tribes: the Cayuse, Walla Walla, and Umatilla. The Tribes ceded the land to the United States in an 1855 treaty (CTUIR, 2001). In 1805, the infamous Corps of Discover led by Lewis and Clark came into the valley. On the Touchet River near it's mouth they wrote "The hills of this creek are generally abrupt and rocky, but the narrow bottom is very fertile, and both possess 20 times as much timber as the Columbia itself; indeed, we now find, for the first time since leaving Rock fort (the Dalles), an abundance of firewood. The growth consists of cottonwood, birch, crimson haw, red and sweet willow, choke-cherry, yellow currants, gooseberry, the sumac, together with some corn-grass and rushes. (Clark and Lewis, 1805-1806)"

The large influx of Euro-Americans to the basin began in the mid-1800's. At this time, timber and brush mixed with grass and forbs were found in the Blue Mountains, bunch grasses in the middle portions of the watershed, and wild rye and sagebrush in the valleys (U.S. Dept of Agriculture, 1941). In 1839, an early explorer near Whitman Mission on the Walla Walla River wrote "The plain about the waters of this river is about thirty miles square. A great part of this surface is more or less covered with bunch grass" (Farnham, 1839). In 1858, Charles Dickerson, the son of an early settler on Pine Creek (near the city of Milton Freewater, OR), remembered the raw farm land of his childhood as being fertile but covered thickly with clumps of tall rye grass (Caverhill, 1971). Further downstream, Lewis and Clark in 1806, and David Douglas in 1826, noted the surrounding country as being predominated by sagebrush.

Horses were introduced into the Walla Walla Valley from New Mexico in the 1730's. Native American Indians began to make use of them soon afterward. In the mid-1800's, large numbers of domestic cattle, sheep, and draft horses were introduced to the area (United States Dept. of Agriculture, 1941). Ultimately the rangelands were overgrazed which, not surprisingly, led to the condition seen today: native plant populations being replaced by more competitive introduced plant species and wide spread soil loss.

The earliest noted agriculture in the valley occurred in about 1825 at Fort Nez Perce, near the mouth of the Walla Walla River (Walt Gary, personal communication). In 1839, the area around Whitman Mission was primarily wheat, corn, onions, melons, and various other crops (Farnham, 1839). Prior to the establishment of Whitman Mission in 1836, the grass covered hills were thought to be only suited for grazing. But by 1850, small amounts of cropland were situated along the river bottoms including some irrigation. In the fall of 1863, a farmer sowed 50 acres of wheat on the upland near Weston and the following summer collected an average of 35 bushels to the acre. From this point forward, land was broken out at an accelerated rate and by the late 1870's, Walla Walla County was considered one of the leaders in cultivated grains (United States Dept. of Agriculture, 1941).

As agriculture in the Walla Walla Valley continued to expand, so too did the availability of large machinery capable of manipulating the landscape. Harper et al. (1938) indicates that steam-powered tractors were available in Umatilla County (Oregon) in 1904 and 1905, caterpillar-type gasoline-powered tractors were introduced from 1907 to 1909, and diesel oil-burning caterpillar type tractors could be purchased in 1932. Riparian areas were cleared for farming and grazing, and extensive channel straightening had begun (Figure 1).

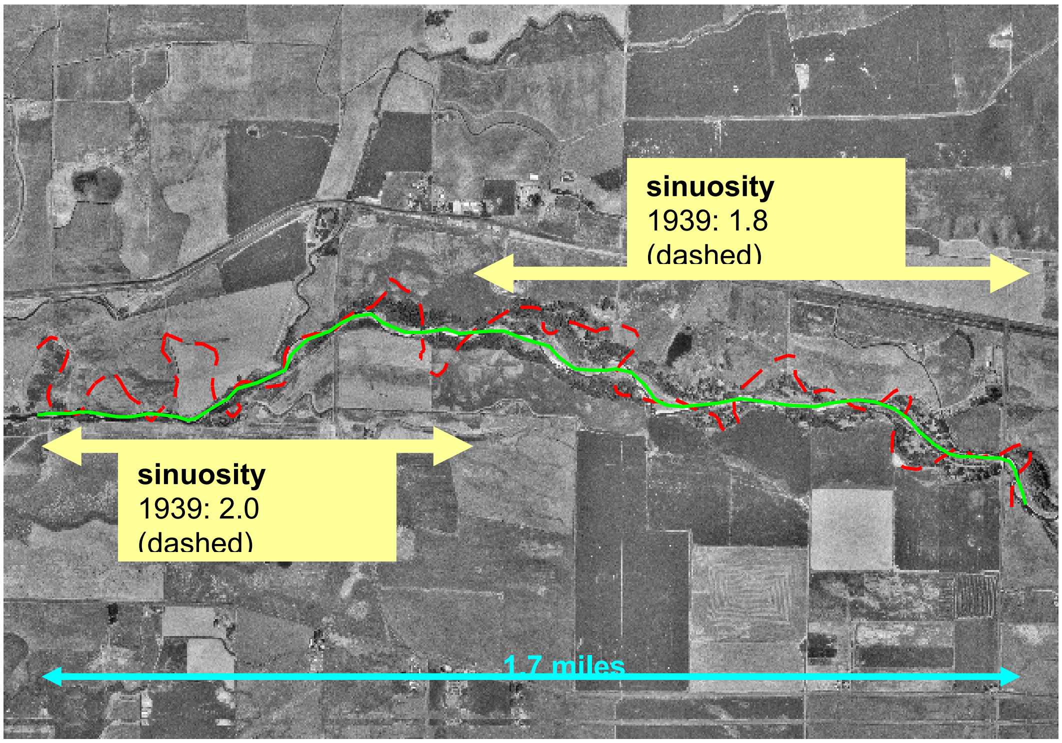

Figure 1: Aerial view of Walla Walla River near Lowden Washington depicting stream channel in 1939 (dashed line) and stream channel in 1996 (solid line) (TMDL Draft, 2001).

A scientist named Dice conducted vertebrate studies in the Touchet River Basin from 1904 to 1914 (Kuttel, 2001). He wrote: “The animal habitats of southeastern Washington have been greatly altered by the work of man. Farming is extensively carried on and in the prairie area a very large percentage of the land is under cultivation. Irrigation is also practiced in valleys of both prairie and sagebrush areas. All of the land not under direct cultivation has been heavily grazed by cattle and stock. Part of the timber along the streams has been cut down and much of the brush has been cleared away…These changes in the environment have caused great changes in the abundance of the different species of vertebrates” (Dice, 1916 cited in Mudd, 1975).

Historical accounts clearly validate the presence of several now extinct species of salmon in the Walla Walla River. Some species, particularly fall chinook and chum, were likely spillover from the Columbia River, essentially of Columbia River origin but using the lower portions of the Walla Walla River for spawning. Nevertheless, runs of spring and fall chinook, chum, coho, and sockeye salmon are reported to have been present at some level (Swindell, 1942). Several historical journals remark that the Touchet, Mill Creek, mainstem Walla Walla, and various other tributaries contained healthy populations of spring chinook salmon at one time. The last spring chinook salmon run of any significance was reported in 1925 (Van Cleve and Ting, 1960). By 1955, only 18 spring Chinook salmon were reported to have been captured in the sport fishery (Oregon Game Commission, 1956 and 1957). Today, the only remaining species include summer steelhead at severely depressed levels, bull trout, resident redband trout, reintroduced spring chinook salmon (adult outplants occurred in the fall of 2000) and possibly Pacific lamprey. Summer steelhead and bull trout are presently listed as threatened under the Federal Endangered Species Act (ESA).

It's important to recognize the impact that over-appropriation of water and inadequate passage conditions had on the once abundant populations of salmon and steelhead in the Walla Walla River Basin. In 1950, Nielson reported a total of 130 points of irrigation diversion in the basin of which 123 had no protective fish device of any kind. Numerous historical journals report "sacks of smolts" being collected from the cropland fields in the spring outmigration months. Early accounts by local people note that annual returns of spring chinook salmon reduced dramatically following the construction of nine-mile dam at Reese Washington in 1905 (Nielsen, 1950; Van Cleve and Ting, 1960). And, Van Cleve and Ting (1960), while summarizing data for the period of 1935-36, wrote that it would be practically impossible for spring chinook salmon to ascend the river under the present system of water use.

INTRODUCTION

Efforts to protect existing populations of summer steelhead and bull trout have increased dramatically in recent years. This is partly a reaction to the federal ESA listing of summer steelhead and bull trout but it also reflects an increased concern of agencies and landowners in the basin. Protection and restoration of the resource is being undertaken by a myriad of State, Federal, Tribal, and local interest groups. Thus far, funding in the basin is being provided primarily by the Bonneville Power Administration (BPA). Hatchery supplementation and reintroduction, instream flow augmentation, habitat protection and restoration, and adult and juvenile passage improvement projects are all part of the plan for restoration.

There are many examples of recently completed or ongoing projects in the basin. The US Army Corps of Engineers (COE) Reconnaissance Study is investigating instream flow enhancement opportunities in cooperation with the CTUIR. Various groups in the basin are pursuing the purchase of water rights from willing sellers. The State of Washington has implemented Senate Bill 5595, which provides funding for habitat restoration efforts in the basin through its Salmon Recovery Funding Board (SRFB). The Bureau of Reclamation (BOR) completed a watershed assessment of the Oregon portion of the basin in 1997; the remaining portion is being written by Washington State University and will be completed in 2002. Fish ladders and screens have been replaced at Burlingame Dam and the little Walla Walla Diversion. A new fish ladder at Nursery Bridge (mainstem Walla Walla River) will be operational during the winter of 2001. Maiden's Dam on the Touchet River and Marie Dorian Dam on the mainstem Walla Walla River were removed. The first phase of a new fish hatchery on the South Fork of the Walla Walla was completed in 1997 and with continued funding, it is expected to produce spring chinook salmon out-migrants for the basin within five years. And, surplus adult spring chinook from Ringold Hatchery, Columbia River, were released into Mill Creek and the South Fork of the Walla Walla in August of 2000 and are expected to provide the first adult return in 2005.

Habitat restoration and protection activities accomplished under this project will compliment the ongoing efforts mentioned above. The specific goal of the project is to "protect and restore habitat critical to the recovery of weak or reintroduced populations of salmonid fish within the Walla Walla River Basin". Habitat interventions will function at a watershed level, seek best scientific approaches and employ passive healing whenever possible. It's expected that over time, critical salmonid spawning and rearing areas will be improved and increased, naturally spawning populations of salmonids elevated, and juvenile outmigration numbers increased.

The project objectives are as follows:

1. Identify, select, and implement habitat restoration and protection projects that provide long-term benefit to biological systems and the salmonid fish relying on them.
2. Improve benefit to salmonid species and biological life within habitat restoration areas through adaptive management.

PROJECT AREA

The Walla Walla River Basin originates in the Blue Mountains at an elevation of nearly 6,500 feet. The watershed encompasses 1,758 square miles in northeast Oregon and southeastern Washington (Figure 2). Of this area, 73 percent is located in Washington and 27 percent in Oregon. The basin is bordered by the Snake River Basin on the north, the Tucannon and Grande Ronde Basins to the east, and the Umatilla Basin to the south (US Army Corps of Engineers, 1997).

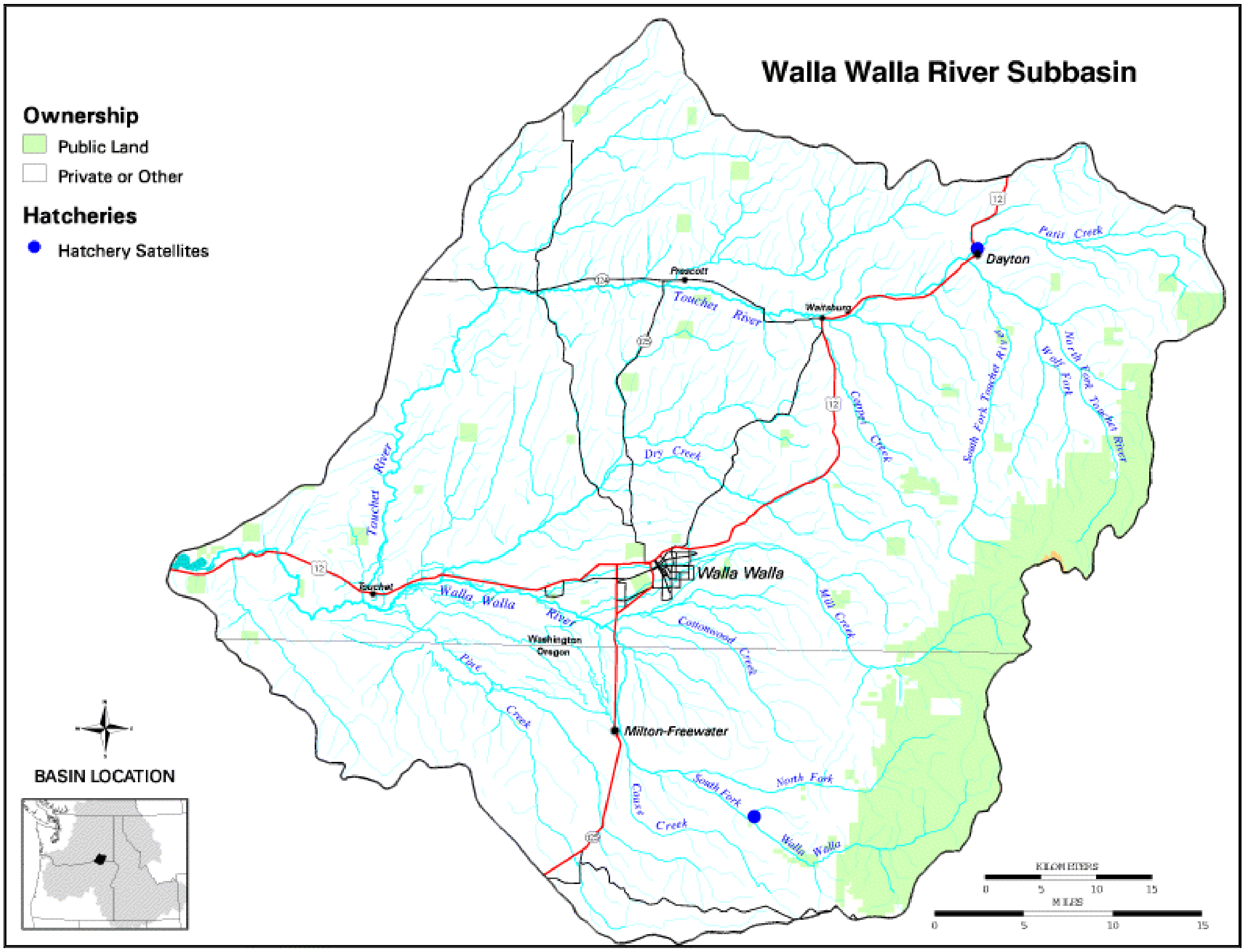

Figure 2: Map of the Walla Walla River Basin.

Annual precipitation in the middle and lower reaches of the basin averages 10-16 inches with more than 40 inches accumulating in higher elevations (Corps of Engineers, 1997).

Cultivation, domestic livestock grazing, and flood control activities have impacted riparian vegetation throughout much of the mid-lower elevation reaches. Loss of channel meander and length as a result of straightening is substantial throughout the basin (see Figure 1). Mudd (1975) estimated that only about 37 percent of the Touchet River riparian zone is currently vegetated. Along the Oregon portion of the Walla Walla River, 70 percent of the existing riparian zone is in poor condition (Water Resources Commission, 1988).

Irrigation is the principal water use in the basin. Stream flows characteristically peak in April, dropping sharply in May as high elevation runoff subsides and low elevation irrigation diversions increase (CTUIR, et al.). These conditions annually lead to unacceptable habitat for salmonid fishes in the mid-lower portions of the basin.

This project currently has habitat restoration and protection sites established on Blue Creek, Couse Creek, the mainstem Walla Walla, and Patit Creek as seen in Figure 3. The project stream miles total approximately 5 miles. The following project area descriptions will provide familiarization with individual sites.

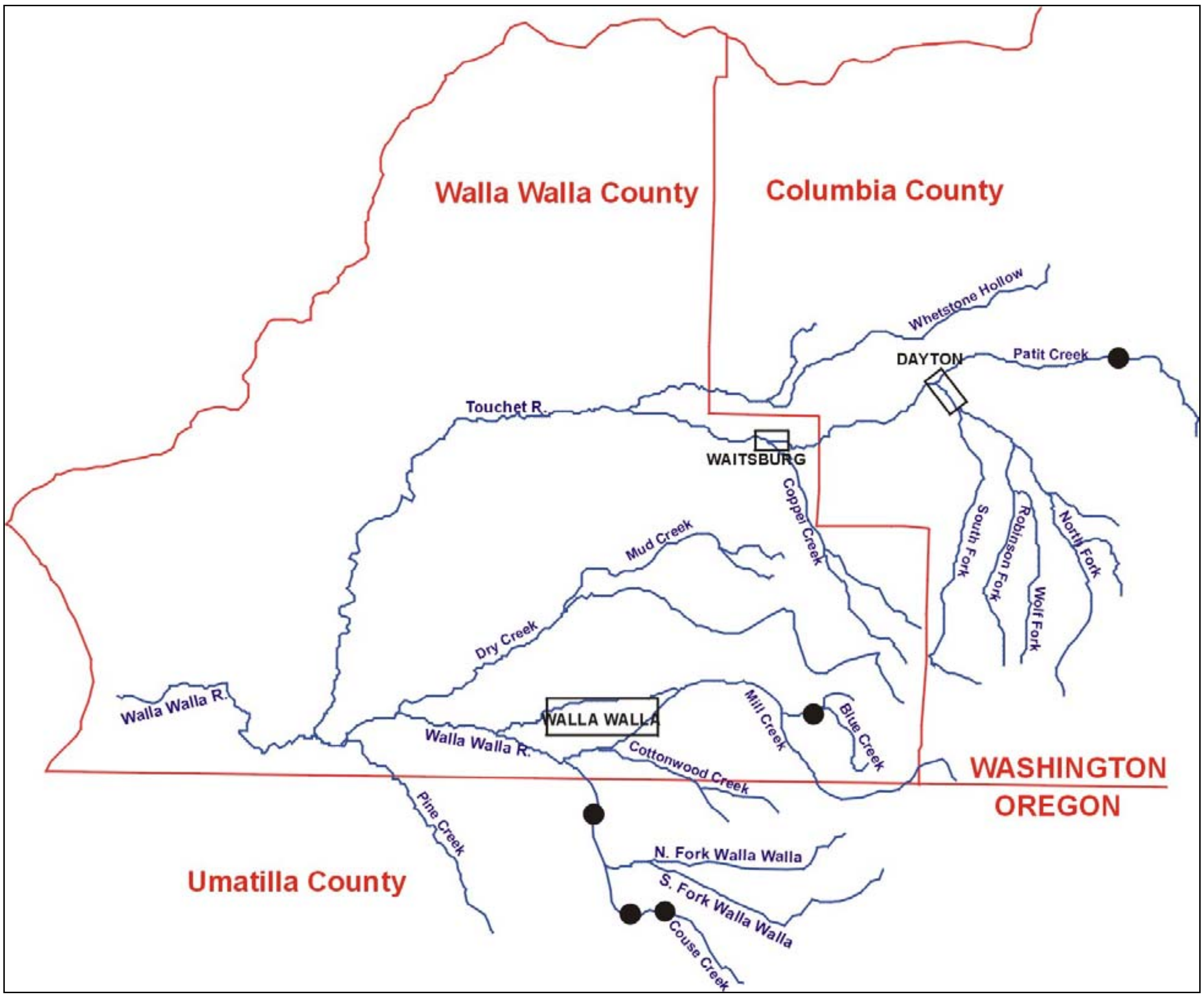

Figure 3: Project locations within Walla Walla Basin.

Blue Creek (Gardner and Langert Landowners)

This project restoration area is located at approximately RM 2 on Blue Creek, a tributary to Mill Creek east of the City of Walla Walla, Washington. The site consists of two adjacent properties with separate owners and Conservation Easements. The 15-year Conservation Easements were signed between the CTUIR and landowners in September of 1997. The site is at an elevation of approximately 1,800 feet. Residential encroachment in recent years is impacting much of the system both above and below the project area. The valley bottom within the project area is approximately 100 yards in width with timbered stringer draws on the south side of the stream and grasslands to the north. The stream length included within the project is approximately 0.25 miles. Stream flows are perennial although very low in late summer. Maximum daily stream temperatures have exceeded 75 degrees (F) in late July of each year. Native redband trout/summer steelhead can be found in the project area throughout the year. One bull trout was found while sampling in October of 1997. The stream and riparian corridor were severely impacted by high water in February of 1996 leaving virtually no riparian vegetation. After the flood event, the stream contained only riffle and riffle/boulder habitat; pool habitat was non-existent and large woody debris absent. Factors limiting salmonid production include stream temperatures, bank and channel stability, pool frequency, large wood, and riparian cover.

Couse Creek (Shumway Landowner)

This restoration project is located at approximately RM 7 on Couse Creek, a tributary to the Walla Walla River near Milton Freewater, Oregon. The 10-year Conservation Easement was signed in 1996 and is between the landowner, the Walla Walla Watershed Council, and the ODFW. The project is approximately 0.5 stream miles in length and at an elevation of 1,600 feet. The predominate land-use is farming and livestock pasture. Past agricultural practices and overgrazing have severely impacted this project site. These activities led to the disappearance of virtually all native riparian plant species and a resulting high incidence of bank failure. The surrounding slopes to the east and west of the stream are used for farming but are also comprised of various perennial grasses and shrub species. Throughout Couse Creek summer flows are ephemeral/subterranean leaving isolated pools and reaches with interrupted flow regimes. Native redband trout can be found in Couse Creek during any month of the year. One bull trout was found downstream of the project area when sampled by the CTUIR in August of 1999. Limited salmonid production within the project area is primarily a result of low or non-existent flows during the summer months, but is also affected by high stream temperatures, bank and channel instability, and lack of channel diversity, low pool frequency, and inadequate riparian cover.

Mainstem Walla Walla River (Lampson Landowner)

This restoration area is located on the mainstem Walla Walla River approximately two miles east of Milton Freewater, Oregon at River Mile 49. The 15-year Conservation Easement was signed between the CTUIR and landowner in April of 1998. The 18-acre project area is located at an elevation of approximately 1,245 feet. The riparian corridor and adjacent floodplain has been managed for agricultural purposes. A large rock dike constructed in the 1960’s confines and straightens the stream along most of its length and nearly all riparian vegetation has been removed since the 1950’s. Historical aerial photos from 1944, obtained from the University of Oregon Library System, show a riparian corridor and floodplain as wide as 300 meters in places dominated by cottonwood. By 1947, 30 percent of the trees had been removed, and by the

1950's, all riparian vegetation had been cleared for agricultural purposes.

The landowners have graciously allowed the CTUIR to have work within a very wide riparian corridor, as much as 300 meters from the stream in some areas. The site contains a considerable amount of aggressive non-native grasses that may prove difficult to manage. Additionally, the COE, landowners, and others are currently working on a plan to reconnect the stream with the floodplain through the removal of the dike; work is scheduled for 2002.

Flows are perennial and stream temperatures are excellent (less than 60 degrees F) throughout the year. Native redband trout/summer steelhead, bull trout, and recently reintroduced spring chinook salmon are present in good numbers. Conditions limiting site potential include decreased pool frequency, lack of large wood, poor instream diversity, reduced riparian cover, and poor floodplain function.

Couse Creek (Hasso Landowner)

This project site is located at approximately RM 7, on Couse Creek, a tributary to the Walla Walla River near Milton Freewater, Oregon. The landowner, a resident of California, signed a fifteen-year Conservation Easement with the CTUIR in December of 1999. The landowner is compensated financially through the Conservation Reserve Enhancement Program (CREP) administrated through the US Department of Agriculture.

The restoration area includes the stream and entire floodplain on both shorelines for a distance of approximately 1.2 stream miles. The property has in the past and still is being heavily grazed by domestic animals. Yellow starthistle (*Centaurea solstitialis*), an aggressive noxious weed, predominates much of the surrounding uplands and riparian corridor. Site restoration is further complicated with shallow soils, ephemeral flow, abrupt changes in valley width, and subsequent substrate deposition. The valley bottom is more than a 100 meters in width in most places although it narrows to less than 50 meters just above the restoration area. This geography greatly enhances the amount of stream bed material deposited during high flow events, creating channel instability and a lack of riparian vegetation. This situation combined with decades of intense livestock grazing has left the floodplain nearly devoid of all vegetation. These limitations have directed us toward focusing available dollars and effort on livestock exclusion and riparian planting.

Throughout Couse Creek, flows are ephemeral/subterranean throughout the summer months leaving isolated pools and reaches with broken flow regimes. Where flow is available, redband trout/summer steelhead can be found during any month of the year. Within the project area, salmonids are most limited by low or non-existent flows during the summer months but also by elevated stream temperatures, bank and channel instability, lack of channel diversity, decreased pool frequency, and reduced riparian cover.

Patit Creek (Brown Owner)

This project area is located at approximately RM 3, on West Patit Creek, a tributary to the Touchet River near Dayton Washington. The landowner signed a fifteen-year Conservation Easement with the CTUIR in November of 1999. The landowner receives financial compensation through the Conservation Reserve Enhancement Program (CREP) administrated through the US Department of Agriculture. The area protected within the project is approximately two miles in length and includes the stream and entire floodplain (exceeding 200 meters in some areas) on both sides of the creek. Timbered stringer draws, shrub species, and grasses are found on the valley slopes to the south while various perennial grasses and invasive yellow starthistle (*Centaurea solstitialis*) dominate slopes to the north.

Flood conditions in 1996 considerably altered channel form and riparian vegetation within the project area, particularly in the upper 0.5 miles of the project. After the flood, the property was managed for livestock, and grazing impacts to the corridor have prevented vegetative recovery. The landowner has allowed the stream to migrate throughout the floodplain in most places encouraging proper stream function and pool formation. On low water years, flows are ephemeral/subterranean during the summer months leaving isolated pools. Despite these conditions, summer steelhead and native red band trout are present in good numbers throughout the year. Other limiting factors include poor bank and channel stability, poor channel diversity, low pool frequency, and inadequate riparian cover.

METHODS

Landowner Conservation Easements

All CTUIR habitat projects are protected under long-term (minimum 15 years) or perpetual Conservation Easements. Landowner easements are designed to protect the resource, the landowner, the investments of CTUIR, and the project's funding sources (primarily Bonneville Power Administration). Easements are very descriptive, clearly defining the project location, riparian corridor width, livestock exclusion fence placement if any, and the expectations and goals of all parties. Under these agreements, landowners are restricted from certain land use activities within the enhanced riparian corridor area, such as grazing, removal of vegetation and use of weed or insect control measures. The CTUIR works with the landowner to address their needs (such as livestock water gaps, stream crossing sites, weed control, etc.) and to incorporate these needs into the final agreement. Once signed by both CTUIR and the landowner, easements are notarized and filed at the County Courthouse. Therefore, easements transfer to new landowners in the event that the property is sold.

Environmental Clearances

Habitat projects typically require a variety of environmental clearances, depending on the restoration action. This permitting process is coordinated with the BPA Environmental Program, under their NEPA process. This process may include obtainment of permits from Umatilla or Walla Walla County to burn noxious weeds within existing project areas. More aggressive instream interventions (revetments, weirs, vanes, barbs, point bar developments, large wood additions, etc.) require Fill and Removal Permits from the applicable State, Federal, and Local regulatory agencies prior to implementation.

The Columbia River population of bull trout (*Salvelinus confluentus*) and mid-Columbia Evolutionary Significant Unit of summer steelhead (*Oncorhynchus mykiss*) are listed as threatened species. Any proposed instream work activities in areas currently supporting these species or providing critical habitat for them, require ESA consultation when federal funding is utilized. Upon completion of a biological assessment, BPA initiates consultation with two federal services. The US Fish and Wildlife Service (USFWS) is consulted with regarding potential impacts to wildlife and resident fish species (such as bull trout). The National Marine Fisheries Service (NMFS) is consulted with regarding potential impacts to anadromous fish species (such as summer steelhead). Biological assessments are reviewed by USFWS and NMFS, during consultation proceedings, and they determine whether an instream project will impact listed species, and how those impacts can be minimized. Consultation proceedings generally delay obtainment of instream permits.

The project also coordinates with CTUIR's Cultural Resource Protection Program (CRPP) at proposed habitat enhancement sites involving ground disturbance (fence construction, instream work, etc.) to obtain cultural and historical clearances. This is required under Section 106 of the National Historical Preservation Act (NHPA). CRPP staff conduct file and literature searches, pedestrian surveys and/or archeological excavations to determine if cultural resources potentially eligible for inclusion to the National Register of Historic Places are present at proposed enhancement sites. Final reports, documenting their findings, are prepared and submitted to the State Historic Preservation Office. CRPP Staff may also conduct on-site monitoring of projects during implementation at culturally sensitive locations.

Project Implementation

Whenever possible, passive riparian restoration approaches are taken. The project feels this approach provides the greatest likelihood of success with minimal disturbance. Heavy equipment, fencing work, and most noxious weed control is subcontracted to independent contractors through a competitive bidding process consistent with federal guidelines.

Where more extensive engineering is needed, projects are designed by the tribal biological and hydraulic staff, in cooperation with the landowner. The implementation plan typically includes the design, quantity and type of materials, access sites for heavy equipment, haul roads and material storage sites.

Fencing is often constructed to exclude livestock from floodplain and riparian areas. Livestock exclusion provides stream bank protection and allows vegetative recovery to occur within project areas. Fences, gates and cross section fences in existing project areas are repaired by project personnel as needed. Frequent fence inspections are conducted to ensure livestock are being excluded from corridor areas.

Native plant species are used for restoration at project sites. Potted plants and tublings are typically obtained through area plant nurseries, including a greenhouse at the local State penitentiary. Plant cuttings are collected at or near the project site and are installed either by trenching or stinging them in with an excavator. Native grass seed and cultivars are acquired from area suppliers and attempts are made to represent historical species composition. For the first couple of years after planting, newly established shrubs and trees are watered from July to September with a 300-gallon tank and sprayer mounted on a flat-bed pickup.

The CTUIR hires local subcontractors to chemically treat noxious weeds in existing project areas as needed. Some spot spraying is completed by project staff. All chemical applications are consistent with Oregon Revised Statute (ORS).570.505 and Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Regulations.

CTUIR Habitat Enhancement Project personnel are involved with all portions of implementation by subcontractors. Upon completion, subcontracted services are inspected to determine whether they conform with contract requirements. If subcontract services are not acceptable, CTUIR may

(1) require the subcontractor to perform the services again in conformity with contract requirements,
(2) reduce the contract price to reflect the reduced value of services performed,
(3) hire another subcontractor to perform the services and charge the original subcontractor any cost incurred by the CTUIR, or
(4) terminate the contract for default.

Any other contracting information may be obtained upon request from the CTUIR Fisheries Department.

Project Monitoring

In 2000 work period, the project recognized the need to improve project monitoring. This resulted in a monitoring plan designed to evaluate habitat recovery of restoration projects. This monitoring protocol was partially adapted from ODFW's "*Methods for stream habitat surveys: Oregon Department of Fish and Wildlife, Aquatic Inventory Project" (1993).* By monitoring the channel and riparian zone within each restoration project, CTUIR fisheries managers will be able to assess site recovery. This monitoring plan is a working draft and is changing as we increase our knowledge of effectiveness monitoring. Continued coordination in-house and with other agencies will be used to refine protocols.

A variety of physical and biotic measures will be used to monitor salmon restoration efforts. Monitoring will focus on factors that are not controlled by upstream conditions so that measurable improvements can be detected in restoration sites. Only those parameters expected to show change over time will be monitored for each project area. Habitat recovery will be measured in terms of regrowth of the riparian vegetation, vegetation structure and cover. In addition, vegetative recovery is related to improvements in bank stability and channel morphology; therefore geomorphic characteristics will also be monitored. Riparian recovery will undoubtedly cause improvements in water temperature, substrate conditions, and fish and macroinvertebrate populations, but local effects would be difficult to discern without great effort and expense. These broader parameters, though not useful for project specific monitoring, are more important when tracking comprehensive basin-wide recovery.

During the longitudinal survey, a survey team walks upstream along the thalweg of the channel and measures the stream length within the project area using a hip chain. While walking the stream, the team identifies individual channel habitat units. Channel habitat units are relatively homogeneous lengths of the stream that are classified by channel bedform, water surface slope, and flow characteristics (e.g. riffle, glide, scour pools). The length of each habitat unit is measured and the depths of all pools are determined.

During the cross-sectional survey, 2-10 permanent transects are established within the project area (depending on project length), ensuring that transects are representative of the different vegetation coverage within the project area. At each cross section, the transect is marked with permanent stakes perpendicular to the stream's thalweg (see Figure 3). The transect will run the entire width of the project area (from fence line to fence line) unless it is more feasible to sample just the floodplain width. Cross sections will be numbered from "1" starting from the downstream end of the project site.

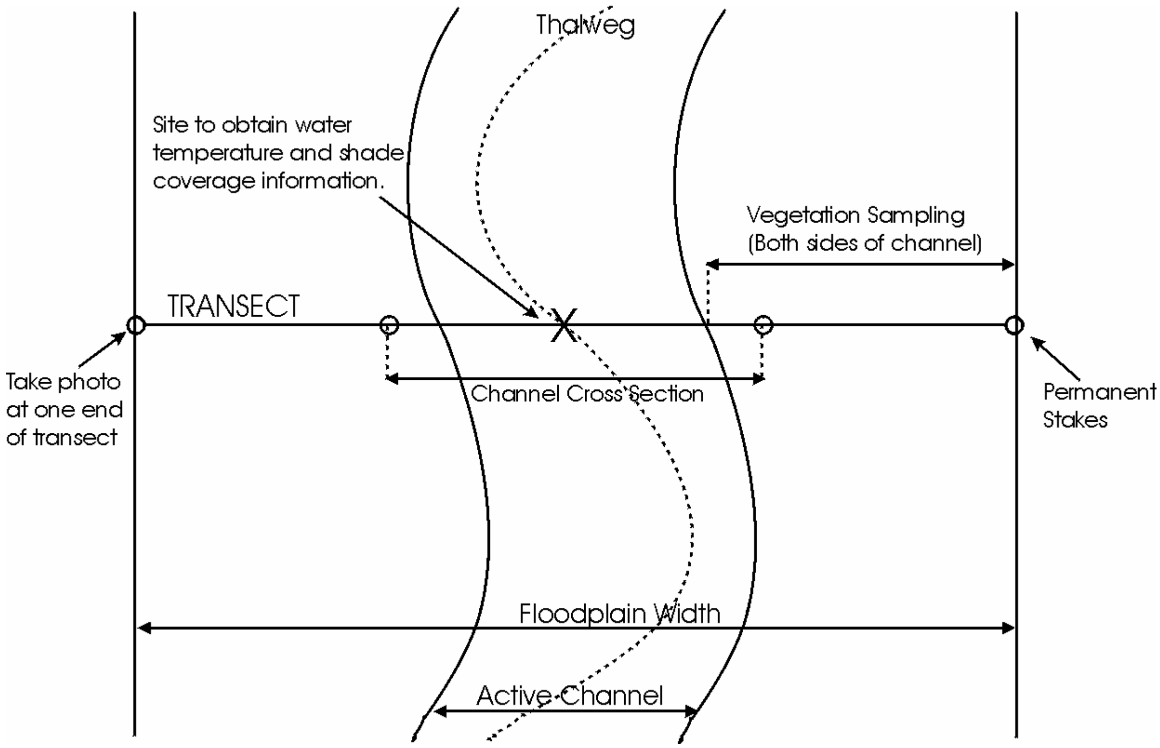

Figure 4: Transect setup for monitoring surveys.

A measuring tape is staked across the width of the stream channel along the transect, and the cross-section is surveyed using a rod and hand level. The elevations are recorded at any major slope breaks within the active channel (see Figure 4). Elevations are also taken at the top of the bank, bankfull, water's edge, bank toe and thalweg. Right and left banks (looking upstream) should be clearly identified in the notes. While collecting cross-sectional information, the wetted width and bankfull width should be measured. Permanent transects should be easily locatable so that they can be repeated over time.

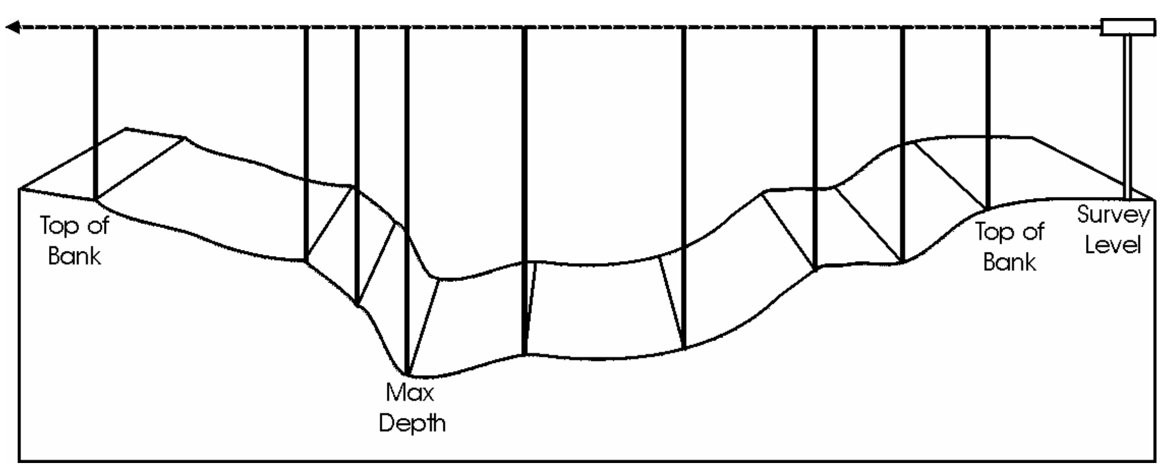

Figure 5: Survey all major slope changes across the active channel.

Vegetation surveys are also conducted along the cross-sectional transect as seen in Figure 3. A measuring tape is stretched from the top of the stream bank, away from the channel, to the end of the transect. At every meter interval, the predominate vegetation along that one-meter portion of the transect is categorized using the classifications developed by ODFW (1993). This procedure is repeated on both sides of the stream. Additional observations may be taken note of at this time (i.e.: large weed infestations, recent evidence of fire, etc.). This compiled information will be used to determine percent ground cover, and proportional vegetative composition indices.

Using a concave spherical densiometer, shade coverage is measured within the stream channel. Shade readings are taken while standing mid-channel along the transect, and four readings are recorded (facing upstream, downstream, to the right bank and to the left bank).

The percent distribution of substrate material are categorized into six size classes (ODFW, 1993). The distribution relative to the total area of the habitat unit (wetted area) is estimated and rounded off to nearest 5-percent.

Using simple field observation, the predominate land use is determined for adjacent terraces and hill slopes that are not part of the riparian zone. The amount of in-channel woody debris is categorized using a classification system that allows for five possible wood classes, each categorizing the complexity and amount of woody debris. A qualitative description is used for the observed stability of both the right and left bank. All of this is accomplished using the classifications devised by ODFW (1993).

Standardized photo points are taken in the summer and provide a visual record of changes in channel morphology and riparian recovery. A photo point notebook, containing 35 mm slides of annual changes, is maintained by the CTUIR Fisheries Habitat Enhancement Project.

Fish surveys are completed by the CTUIR Natural Production Program (BPA Project #200003900) using their methodology. Fish samples are collected with a backpack electroshocker within project areas. A single pass with the electroshocker is made to evaluate community composition. All salmonids captured are counted, fork lengths measured and identified to species in the field. All non-salmonid fish species numbers are visually estimated during sampling. These surveys are not conducted annually, in an attempt to reduce stress to fish, especially ESA listed species.

Basin-wide Temperature Monitoring

Water temperature data is collected throughout the Walla Walla Basin. The project shares this information with others in the basin to reduce duplication of effort and improve overall understanding of temperature profiles limiting salmonid production. Following is a list of monitoring locations and dates for temperature data collected in the reporting period:

1. Mainstem Walla Walla River at RM 9, deployed from June 26 through October 7, 2001.
2. North Fork Walla Walla River at RM 0.25 deployed from May 31 through October 7, 2001.
3. South Fork of the Touchet River at RM 8, deployed from May 31 through October 4, 2001.
4. Mill Creek at RM 11, deployed from May 31 through October 6, 2001.
5. Blue Creek at RM 2.4, deployed from June 1 through October 6, 2001.
6. Little Walla Walla River Diversion (within the diversion canal at the juvenile screens), deployed from June 26 through October 8, 2001.

RESULTS AND DISCUSSION

Blue Creek

This project area is located at approximately RM 2 on Blue Creek, a tributary to Mill Creek about 10 miles east of the city of Walla Walla, Washington. Blue Creek has strong populations of redband trout/steelhead and at least some bull trout (one was electroshocked by the CTUIR in 1997). The site consists of two adjacent properties with separate landowners. Conservation easements were signed with each of the landowners in 1997. The project areas were heavily impacted by the high water of February 1996. The landowners at that time did extensive dozer work and large rock placement in an attempt to control flood waters. This left the riparian corridor entirely devoid of all vegetation and eliminated any instream diversity.

Initial efforts for this project focused on the protection of eroding banks by restoring riparian plants. We chose to leave the channel in its current form as it had found a stable configuration. An additional objective of improving pool frequency and presence of large wood was included as part of this effort. In the fall of 1997, three rock vortex weirs were constructed, two of which are still visible; the third is completely embedded in gravel. Three log V-weirs and one straight log weir were built during this same time. Several thousand willow and cottonwood cuttings were placed during excavation.

In general the rock vortex weirs have been effective at reducing bank erosion. This has of course assisted in the recover of riparian vegetation. They have proven less effective at providing instream habitat for fish. The vortices incorporated into the design effectively move flows and entrained debris toward the center of the channel as expected but limit the formation of pool habitat. One of the rock weirs has been entirely buried in gravel and is no longer functioning.

The log V-weirs have functioned as designed and have provided some exception instream pool habitat for fish. One of these weirs required maintenance during the 1999 work period. It's hoped that this will not be an ongoing problem. In retrospect, however, the resilience and versatility of rock structures may have been more appropriate, particularly in areas with minor channel incision and a properly functioning floodplain. The project does not intend to construct any log-V-weirs in the future.

Native plant restoration efforts have been very effective. Nearly all of the willow cuttings placed during excavation and subsequent planting efforts of rooted stock plants have survived. It's worth noting that the riparian corridor of this project area is almost exclusively river rock (please see 1998 photos below) and virtually no soil can be observed whatsoever. The project did hand-water the rooted stock plants the first two years following reintroduction.

The following photo points portray the significant vegetative recovery that has occurred at this project site.

May 1998 **July 2001**

In 2000, the CTUIR habitat program began drafting monitoring protocol for restoration projects. Site specific monitoring data was collected for several sites, including Blue Creek. This process was repeated during this reporting year. The summary of this data can be viewed in Table 1. This monitoring data will be used to track site recovery over time and develop future restoration activities.

Table 1: Monitoring survey results from Blue Creek Project Area (Surveyed August 2001).

Category	Parameter	2000	2001
Channel Description	Water Temp. (C)	23.3	17.2
	Land Use	Rural Residential	Rural Residential
	Wetted Width (m)	3.6	3.8
	Bankfull Width (m)	9.5	4.8
	Wood Class (#)	1	2
Substrate	% Fine	33%	33%
	% Gravel	38%	30%
	% Cobble	23%	35%
	% Boulder	5%	2%
	% Bedrock	0%	0%
% Shade	% Shade Upstream	23%	45%
	% Shade Right Bank	6%	52%
	% Shade Downstream	42%	12%
	% Shade Left Bank	17%	40%
	% Shade Average	22%	37%
Vegetation Cover	% No Vegetation	45%	19%
	% Annual grasses/herbs	45%	16%
	% Perennial grass	0%	36%
	% Shrubs	10%	37%
	% Deciduous dominated	0%	0%
	% Mixed conifer/deciduous	0%	8%
Habitat Units	% Dry	0%	0%
	% Glide	15%	9%
	% Riffle	63%	64%
	% Riffle With Pockets	0%	0%
	% Rapid	0%	0%
	% Cascade over Bedrock	2%	2%
	% Pool	0%	0%
	% Lateral Scour Pool	7%	5%
	% Plunge Pool	11%	14%
	% Straight Scour Pool	0%	5%
	% Trench Pool	1%	0%

Many of the limiting factors that we were capable of addressing on Blue Creek are being met. In particular, the average amount of shade measured within the stream channel has increased significantly within one reporting year. This is most likely associated with the recovery of native vegetation evident in both the photo points and the vegetation surveys. We will continue to maintain the instream structures and collect monitoring information.

Couse Creek (Shumway landowner)

This property was first signed into a protection easement by the ODFW and local Watershed Council in 1996. Prior to that the land had been managed for agriculture and livestock grazing. The CTUIR became involved with the project in 1997, providing additional technical assistance and funding from the Bonneville Power Administration. Our primary objective at that time was to reduce bank erosion and improve riparian habitat through the reintroduction of native vegetation. Five rock barbs designed by NRCS in Pendleton Oregon were constructed along two actively eroding shorelines in October of 1997. Large cottonwood trees (excavated nearby) and several thousand native willow cuttings were placed between the rock barbs to provide additional bank protection and instream habitat.

By the spring of 1999, the reintroduced willows had established themselves. The barbs, although very effective at reducing erosion, had forced the stream channel away from the shoreline. This unfortunately eliminated all of the benefits we had hoped to maintain along the stream bank including shade, pool formation, cover, etc. We now realize that the barbs were over-designed. A less aggressive design may have allowed us to protect the bank while still maintaining the shoreline diversity. We will continue to monitor these changes and provide any new data in future reports.

Various strategies for riparian revegetation have been applied within this project area. In addition to the willows mentioned above, several thousand young plants (3-10 inch tall) were placed as rooted stock in past years. In general, survival of these plants has been poor, largely because of competition from non-native species and drought conditions during the summer months. The CTUIR has no future plans for use of bare-root plants at this site in the future.

During the 2001 reporting period, several days were spent either hand-pulling or spot spraying invasive and noxious weeds. Riparian plants were hand-watered with a 300 gallon water tank during the months of August and September. We do not intend to water any longer at this site as the plants are now mature enough to survive on their own. The CTUIR continued coordination with the landowner and the local Watershed Council. The landowner has expressed interest in widening the riparian corridor within the existing project area and signing an additional one mile of Couse Creek into a conservation agreement. This work is expected to occur in 2002. All long-term monitoring parameters for this project site are being collected by ODFW.

Mainstem Walla Walla River (Lampson Landowner)

The 15-year riparian easement for this property was signed in 1998. The 18-acre project area had in the recent past been used for an orchard. Our first task for this property was to establish a stand of native perennial grasses. This was expected to reduce competitive weed problems prior to the reintroduction of native tree and shrub species. In 1999, the project site was seeded to native grasses; however, the grass did not establish itself well. We are unsure as to why this happened although we suspect that most of the grass was out-competed by non-native species. As a result, in 2000, the project area was tilled again, chemically treated for weeds, and reseeded. The second seeding has produced mixed results. Portions of the project area are now dominated by desirable perennial grass stands while others sections are still impacted by strong populations of non-native species, particularly reed canary grass (*Phalaris arundinacea*). Chemical weed control and mowing will continue to be part of our management strategy at this site.

In the spring of the reporting period, the project purchased 36 large (41’ x 100’) black plastic tarps from Layfield Plastics Incorporated of Bellevue, Washington. The tarps are designed to eliminate competitive weed problems and aid in the maintenance of soil moisture. The life of the tarps is said to be about five years although we suspect it may be much longer. Each tarp was secured in place by burying the perimeter with a small tractor. Small rocks were also positioned onto the tarps as additional protection against high winds. We made every attempt to place the tarps in a random pattern across the field. It was thought that by doing so we would best mimic the natural succession of a shrub, tree, and grass ecosystem.   Each tarp was planted with a compliment of approximately 200 native plant species appropriate for the site. Plants were maintained throughout the year with summer watering (using a water truck) and hand weeding. Thus far, survival of the plants in the tarps has varied from 60 to 90% and growth has been exceptional.

The project continued weed control measures throughout the growing period. Pendleton Grain Growers was hired to apply two applications of broadleaf spray on the 18 acres of project corridor. Hand pulling and spot-spraying but project staff was done as needed.

August 1998 **July 2001**

In 2000, the CTUIR habitat program began drafting monitoring protocol for restoration projects. Site specific monitoring data was collected for several sites, including this project site. This process was repeated during this reporting year. The summary of this data can be viewed in Table 2. This monitoring data will be used to track site recovery over time and develop future restoration activities.

Table 2: Monitoring survey results from Lampson Project (surveyed August 2001).

Category	Parameter	2000	2001
Channel Description	Water Temp. (C)	17.0	13.7
	Land Use	Rural Residential	Rural Residential
	Wetted Width (m)	16.2	13.7
	Bankfull Width (m)	18.5	18.5
	Wood Class (#)	1	2
Substrate	% Fine	30.0	0.0
	% Gravel	33.3	36.7
	% Cobble	30.0	56.7
	% Boulder	6.7	6.7
	% Bedrock	0.0	0.0
% Shade	% Shade Upstream	7.7	12.5
	% Shade Right Bank	44.3	46.5
	% Shade Downstream	8.7	15.3
	% Shade Left Bank	25.3	61.4
	% Shade Average	21.5	33.9
Vegetation Cover	% No Vegetation	10.9%	12.7%
	% Annual grasses/herbs	86.6%	69.7%
	% Perennial grass	0.0%	6.7%
	% Shrubs	1.3%	0.4%
	% Deciduous dominated	1.0%	10.4%
	% Mixed conifer/deciduous	0.0%	0.0%
Habitat Units	% Dry	0.0%	0.0%
	% Glide	34.4%	23.3%
	% Riffle	59.5%	54.0%
	% Riffle With Pockets	0.0%	0.0%
	% Rapid	6.1%	6.4%
	% Cascade	0.0%	0.0%
	% Pool	0.0%	0.0%
	% Lateral Scour Pool	0.0%	16.3%
	% Plunge Pool	0.0%	0.0%
	% Straight Scour Pool	0.0%	0.0%
	% Trench Pool	0.0%	0.0%

Although the percent of ground cover left un-vegetated has increased from last year, the amount of instream shade has improved. That is because the vegetation surveys reflect the installation of the tarps, while the streamside vegetation continues to improve and provide increased shade to the stream. There also appears to be a dramatic decrease in the amount of fines present in the river during the survey. There were not extraordinarily high flows during 2001 that could potentially flush fines from the substrate, so it is uncertain why this trend was evident. In fact, peak flows at the Walla Walla River USGS gage station #14018500 near Touchet were higher in 2000 (Feb. 15, 2000 = 3,540 cfs) than the in 2001 (Feb. 15, 2001 = 2,780 cfs). Future monitoring will continue and determine trends in substrate composition.

Couse Creek (Hasso Landowner)

The soils within this site are shallow and the riparian corridor has been severely impacted for more than 50 years by livestock. The upland slopes have also been over-grazed and much of the perennial grass habitat that once dominated is now overcome with various invasive non-native species. The current landowner has continued the grazing process with first sheep, and more recently cattle. Grazing activities are combined with prodigious amounts of bed material following each high water event as a result of a dramatic change in valley width at the top of the project area. Stream braiding is common throughout most of the project area as is intermittent flows. In recent years the stream channel has been dry from late June through October. The area does, however, contain a substantial population of resident red band trout and native summer steelhead during portions of the year. Several summer steelhead redds are observed within the project area each spring.

A 15 year riparian easement was signed with the landowner in December of 1999 and in February of the following year a livestock exclusion fence was constructed. It was decided to forego the use of any bare-root stock plants at this site because of the poor soil conditions, and the harsh summer environment. Instead the project chose to hasten recovery through the installation of willow cuttings within the floodplain. Several thousand native willow cuttings were collected nearby on the North Fork of the Walla Walla River and placed with an excavator during the 2000 reporting period. Survival of the cuttings was higher than 80% the following spring but as summer progressed many of the plants began to die. Today, survival of the cuttings is estimated at 15% and we expect that most of all these plants will survive.

December 1999 **July 2001**

In 2000, the CTUIR habitat program began drafting monitoring protocol for restoration projects. Site specific monitoring data was collected for several sites, including this project site. This process was repeated during this reporting year. The summary of this data can be viewed in Table 3. This monitoring data will be used to track site recovery over time and develop future restoration activities.

Table 3: Monitoring survey results from Hasso Project (surveyed August 2001).

Category	Parameter	2000	2001
Channel Description	Water Temp. (C)	Dry	Dry
	Land Use	Heavy Grazing	Light Grazing
	Wetted Width (m)	Dry	Dry
	Bankfull Width (m)	8.8	9.7
	Wood Class (#)	1	1
Substrate	% Fine	20%	13%
	% Gravel	48%	50%
	% Cobble	30%	28%
	% Boulder	3%	9%
	% Bedrock	0%	0%
% Shade	% Shade Upstream	2%	1%
	% Shade Right Bank	7%	2%
	% Shade Downstream	1%	2%
	% Shade Left Bank	2%	2%
	% Shade Average	3%	2%
Vegetation Cover	% No Vegetation	50.6%	-
	% Annual grasses/herbs	37.0%	-
	% Perennial grass	0.8%	-
	% Shrubs	11.6%	-
	% Deciduous dominated	0.0%	-
	% Mixed conifer/deciduous	0.0%	-
Habitat Units	% Dry	100.0%	100.0%
	% Glide	0.0%	0.0%
	% Riffle	0.0%	0.0%
	% Riffle With Pockets	0.0%	0.0%
	% Rapid	0.0%	0.0%
	% Pool	0.0%	0.0%
	% Lateral Scour Pool	0.0%	0.0%
	% Plunge Pool	0.0%	0.0%
	% Straight Scour Pool	0.0%	0.0%
	% Trench Pool	0.0%	0.0%

Patit Creek (Brown Landowner)

This project area is located in the foothills east of Dayton Washington on Patit Creek, a tributary of the Touchet River. The stream contains healthy populations of redband trout and summer steelhead. The area of protection is two miles in length and includes the entire floodplain on both shorelines. The stream is small and flow is reduced to very low levels in some years (please see photos below). A 15 year easement was signed with the landowner in November of 1999. Four miles of riparian fence was constructed along the entire perimeter of the project in March of the following year. The CTUIR then applied for and received a grant totaling $55,000 from the Salmon Funding Recovery Board (State of Washington funding source).   These dollars were combined with funds from the BPA to further implementation. A site plan was developed in coordination with the landowner to reconstruct the stream meander and restore riparian vegetation and floodplain function in the uppermost half mile of the project area. This section of the stream and adjacent corridor was significantly damaged by high water in February of 1996. Implementation included the construction of eight vortex weirs, two rootwad revetments, two keyed log-jams, meander bend enhancement and point-bar development. Several thousand will cuttings were installed by both trenching and stinging at this same time.

Today the channel is functioning as we had designed and the willow cuttings placed during implementation are thriving. Some additional floodplain planting was done within the reporting period. The list of species included ponderosa pine, willow, and cottonwood among others. These plants were hand watered several times during the months of August and September. We will report on the success of these efforts and all other monitoring parameters in 2002.

July 2000 **July 2001**

In 2000, the CTUIR habitat program began drafting monitoring protocol for restoration projects.

Site specific monitoring data was collected for several sites, including this project site. This process was repeated during this reporting year. The summary of this data can be viewed in Table 4. This monitoring data will be used to track site recovery over time and develop future restoration activities.

Table 4: Monitoring survey results from Brown Project (surveyed August 2001).

Category	Parameter	2000	2001
Channel Description	Water Temp. (C)	25	24
	Land Use	Light Grazing	Light Grazing
	Wetted Width (m)	3.6	2.4
	Bankfull Width (m)	10.0	7.4
	Wood Class (#)	1	1
Substrate	% Fine	25.0	12.5
	% Gravel	35.0	25.0
	% Cobble	27.5	53.3
	% Boulder	14.2	9.2
	% Bedrock	0.0	0.0
% Shade	% Shade Upstream	21.8	16.5
	% Shade Right Bank	26.2	27.6
	% Shade Downstream	14.0	15.1
	% Shade Left Bank	32.2	40.4
	% Shade Average	23.5	24.9
Vegetation Cover	% No Vegetation	23.8%	20.4%
	% Annual grasses/herbs	63.3%	12.2%
	% Perennial grass	0.0%	28.0%
	% Shrubs	13.0%	15.9%
	% Deciduous dominated	0.0%	1.9%
	% Mixed conifer/deciduous	0.0%	21.7%
Habitat Units	% Dry	12.9%	-
	% Glide	6.0%	-
	% Riffle	51.3%	-
	% Riffle With Pockets	15.8%	-
	% Rapid	0.3%	-
	% Pool	0.3%	-
	% Lateral Scour Pool	6.5%	-
	% Plunge Pool	4.0%	-
	% Straight Scour Pool	2.9%	-
	% Trench Pool	0.2%	-

Basin-wide Temperature Monitoring

Six thermographs were deployed throughout the Walla Walla Basin during the 2001 reporting period. The graphed and tabulated data collected can be viewed in Appendix A.

1. The mainstem Walla Walla River at RM 9 was deployed from June 26 through October

7, 2001. Temperatures ranged from a daily minimum of 53.6 degrees Fahrenheit on October 7 to a daily maximum of 82.0 degrees Fahrenheit on July 4, 10 and 12 (Appendix A: Figure A-1 and Table A-1).

2. The North Fork of the Walla Walla River at RM 0.25 was deployed from May 31 through October 7, 2001. Temperatures ranged from a daily minimum of 48.9 degrees Fahrenheit on June 13 to a daily maximum of 74.1 degrees Fahrenheit on August 14 (Appendix A: Figure A-2 and Table A-2).

3. South Fork of the Touchet River at RM 8 was deployed from May 31 through October 4, 2001. Temperatures ranged from a daily minimum of 50.3 degrees Fahrenheit on June 4 to a daily maximum of 78.8 degrees Fahrenheit on August 14, 2001 (Appendix A: Figure A-4 and Table A-4).

4. Mill Creek at RM 11 was deployed from May 31 through October 6, 2001. Temperatures ranged from a daily minimum of 47.7 degrees Fahrenheit on October 5 to a daily maximum of 76.9 degrees Fahrenheit on July 9 (Appendix A: Figure A-1 and Table A-1).

5. Blue Creek at RM 2.4 was deployed from June 1 through October 6, 2001. Temperatures ranged from a daily minimum of 43.7 degrees Fahrenheit on October 5 and 6 to a daily maximum of 79.4 degrees Fahrenheit on July 4 (Appendix A: Figure A-1 and Table A-1).

6. Little Walla Walla River Diversion (within the diversion canal at the juvenile screens), was deployed from June 26 through October 8, 2001. Temperatures ranged from a daily minimum of 46.0 degrees Fahrenheit on October 5 to a daily maximum of 69.8 degrees Fahrenheit on July 12 (Appendix A: Figure A-2 and Table A-2).

Additional accomplishments

Additional results and accomplishments made during the reporting period include:

- Coordinated with various local, State, and Federal agencies in the prioritization and selection of habitat restoration sites;

- Conducted on-site visits with landowners, evaluated site potential for restoration (access, landowner participation, cost-share, likelihood of success, benefit to target species);

- Developed grants and proposals for cost-share opportunities.

- Received $11,900 dollars in cost-share for 6 months of one “summer help” fisheries technician from the United States Work Force Investment Act.

- Received $24,960 dollars in cost-share for 6 months of project leader time from Casino Funding, CTUIR.

- Secured all necessary State, Federal, and local permits necessary for instream work;

- Provided written comments to ODFW/WDFW and others regarding various proposed instream/upland activities impacting salmonid habitat;

- Coordinated with participating landowners as necessary;

- Prepared quarterly and annual reports of progress;

- Attended basin strategy, planning, and funding meetings as necessary;

- Provided educational habitat restoration and protection presentations to area schools and interested groups;

- Provided tours to the NWPPC, BPA, and others of habitat restoration project sites;

- Participated in Walla Walla Watershed Council meetings;

- Collected monitoring data during the months of July and August for each project site.

- Worked closely with a landowner, WDFW, in the removal of a passage barrier on Whiskey Creek, a tributary to the Touchet River. The project provided $8,500.00 for this effort.

- The assistant project biologist attended three days of training for NEPA, ESA, and Section 106 of the National Historic Preservation Act. This training has allowed project personnel to better handle federal regulations surrounding habitat improvement projects. The cost for registration was $580.00.

- A total of $7,351.00 was provided to the Eastern Oregon Correctional Institute (EOCI) for the propagation on native plants to be used within project areas in 2002 and 2003. EOCI is providing these plants to us at their cost. They are collecting seeds and cuttings at or very near each of our project sites.

Discussion:

Habitat projects funded within the scope of this document are implemented on private lands within the Walla Walla River Basin. Consequently, project success hinges on volunteer participation of private landowners. Landowner interest and participation has been favorable thus far. As a result of improved education, awareness, funding, and imposing environmental laws, private landowners are increasingly willing to work for the benefit of fish and wildlife.

Large portions of the Walla Walla River Basin are privately owned and individual land-holdings are often small. This complicates the exercise of securing Conservation Easements along large reaches of river. These circumstances elevate the importance of focusing restoration dollars on proven long-term solutions and in areas of the basin expected to provide the greatest benefit to salmonid fish.

Riparian vegetation is frequently the principal element affecting water quality and floodplain function at project sites. Arid conditions prevailing in the region throughout much of the growing season inhibits natural riparian re-growth and species succession. It is with this understanding that we have focused much of our attention on the restoration of plant communities.

Planting techniques implemented within the scope of this project have led to mixed results. Plant survival has been the highest with willow cuttings placed below the water line with the use of an excavator (stinger or trenching). This method has been successful in both the early spring (March) and late fall months (late October and November). However, fall months may provide a better opportunity for root growth prior to summer drought if given the choice. It's worth noting that cottonwood cuttings placed the same way have survived poorly. Other planting approaches, including rooted stock and hand-placed cuttings, although helpful, have been far less successful and economical.

If using rooted stock, the use of larger plants with more developed root systems may be beneficial. Native pioneer plant species seem more tolerant to prolonged periods of drought and exposure, such as wild rose and hawthorn, appear to survive better at arid sites. It's expected that once these are established, less resistant varieties will naturally succeed. Of course each site is unique. The restoration approach must consider historical species composition, soil type, exposure, flood interval, elevation, and various other factors. Some reaches will easily revegetate themselves if given several years of rest, particularly those bathed in shade and complimented by deep soils. Others will express slow recovery at best, requiring replanting, periodic maintenance and perhaps decades to eventually achieve a climax plant community.

The project has been experimenting with the use of tree shelters and tree mats. The shelters, manufactured by Treessentials Company, Minnesota, are plastic tubes (two feet in length, four-inch diameter) designed to enclose and protect the young plant from animal browsing and girdling, drought, wind, and competition. The shelters have proven beneficial but survival has not been high enough to merit their exclusive use. We have also been experimenting with tree mats designed to reduce weed competition and moisture loss. The mats, composed of a fibrous material, are staked at the base of the plant and designed to decompose over a period of five years. Limited success has resulted from the use of the mats, however, and there is a need for continued maintenance as a result of wind damage. We now feel that the mats were too small to provide the desired result (3'x3'). This reporting period, we implemented the use of much larger mats (100'x40') at the site on the mainstem Walla Walla River. These tarps were secured in place by burying the edges with soil and then staking and weighting the center portions of the tarp. The tarps were then "clump" planted in the spring with site-appropriate native species. In less than one complete year, we have already seen a significantly higher planting success in the tarps. The soil under the tarps seems to be maintaining moisture for longer periods. There has been some deer browsing, but it has not generally contributed to plant mortality. Further out-year monitoring of the tarps will determine the long-term success of this planting technique.

CONCLUSION

A multitude of factors have led to the extinction of salmon and severe reduction of summer steelhead in the Walla Walla River Basin. Undoubtedly though, irrigation withdrawals and inadequate passage conditions have been the most damaging. Today, there are still migration barriers in the basin that partially or entirely prevent adult and juvenile migration. And, despite the fact that salmon are extinct and summer steelhead and bull trout are now listed under the Endangered Species Act, there are today, as there was a hundred years ago, irrigation withdrawals that completely de-water streams for months of the year.

In recent years, particularly since the listing of several species under the Endangered Species Act, we have begun to take the first steps toward protection of salmonid fish in the Northwest. The Endangered Species Act, Clean Water Act, and a myriad of state and federal funding programs aimed at salmon programs have kicked off a great start to fisheries restoration. With time, education, and continued funding, many of the obstacles now facing salmon can be eliminated. Eventually, however, those living in the Walla Walla River Basin and throughout the Northwest will be forced to decide what they are willing to sacrifice for the sake of these fish. These trade-offs are revealing themselves today in the form of electrical rate increases, reduced and altered timber harvest, changing farm practices, and water conservation.

Biologically, it's clear what is necessary to save salmon. But at this time, it's also clear that our current efforts to protect them are not enough. Salmon in the Northwest are indeed swimming toward elimination. We must strive to protect and enhance all salmonid habitat and enforce existing laws structured to protect the salmon life cycle. Logging, grazing, and agriculture can coexist with the needs of salmon if managed appropriately. Working together, and in the interest of all, we can continue to live as we have in the last century, while protecting a species that has thrived in this region for thousands of years. We must continue to learn, always striving to improve our methods of restoration and protection. Stream buffers and zoning laws that protect riparian areas from further development are desperately needed. Minimum stream flows must be maintained to protect critical spawning, rearing, and migration periods. And, with ever increasing amounts of dollars invested by state and federal agencies, its imperative that restoration projects focus in areas that provide the greatest benefit to salmonid fishes. Ultimately, and perhaps sadly, the future of the salmon depends only on our willingness to protect it.

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Finally, I wish to thank the many landowners in the Walla Walla River Basin committed to making a difference for future generations of Fish and Wildlife.

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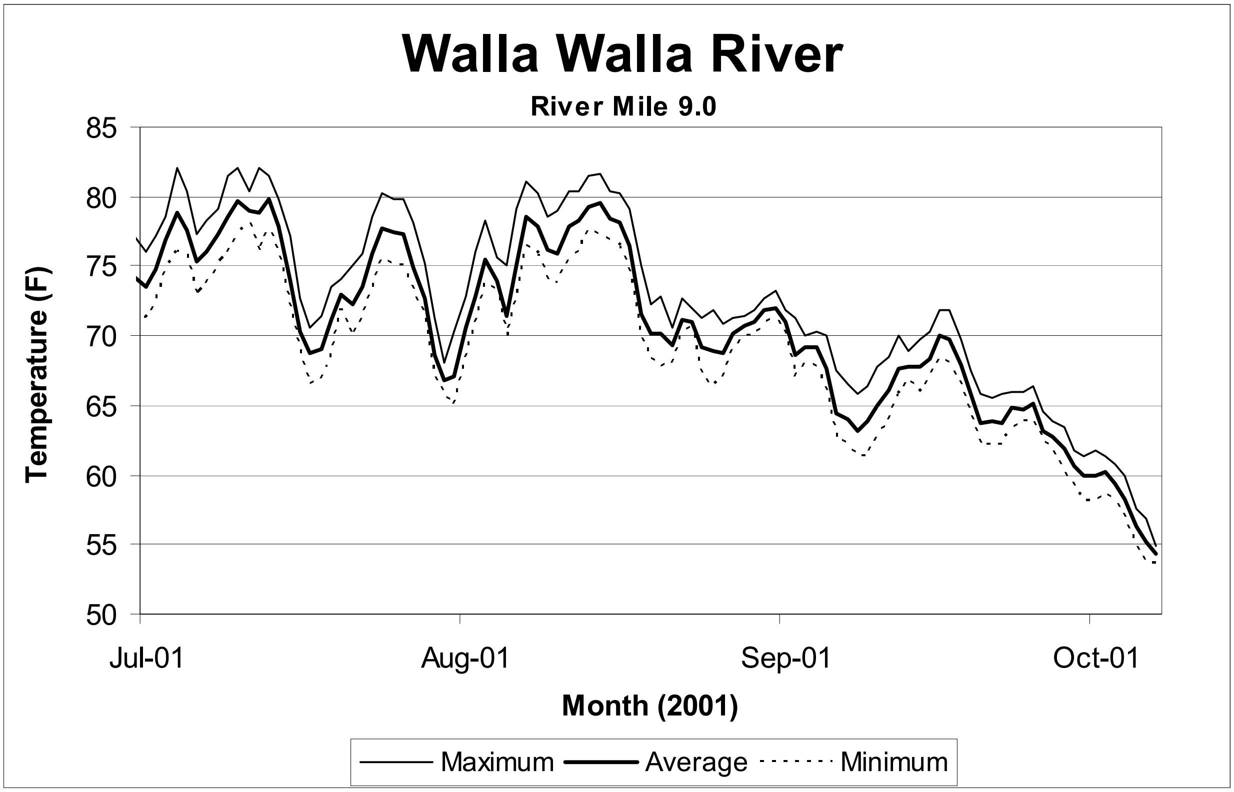
APPENDIX A – Figures and Tables

Figure A-1: Maximum, minimum and average stream temperatures for the Walla Walla River (RM 9.0)



File Name: Walla2 (RM9) – 2001.xls

Table A-1: Water temperature data for the Walla Walla River at River Mile 9.0 for June 26, 2001 through October 7, 2001.

		Fahrenheit			Celsius	
DATE	Maximum	Average	Minimum	Maximum	Average	Minimum
26-Jun-01	70.5	68.4	66.4	21.4	20.2	19.1
27-Jun-01	72.0	70.2	68.9	22.2	21.2	20.5
28-Jun-01	75.0	72.3	70.5	23.9	22.4	21.4
29-Jun-01	75.9	72.3	68.5	24.4	22.4	20.3
30-Jun-01	77.2	74.3	71.4	25.1	23.5	21.9
1-Jul-01	76.1	73.5	71.2	24.5	23.1	21.8
2-Jul-01	77.2	74.8	72.3	25.1	23.8	22.4
3-Jul-01	78.6	76.9	74.7	25.9	24.9	23.7
4-Jul-01	82.0	78.9	76.1	27.8	26.0	24.5
5-Jul-01	80.4	77.6	75.9	26.9	25.4	24.4
6-Jul-01	77.4	75.4	72.9	25.2	24.1	22.7
7-Jul-01	78.3	76.1	73.8	25.7	24.5	23.2
8-Jul-01	79.2	77.3	75.0	26.2	25.2	23.9
9-Jul-01	81.5	78.6	76.1	27.5	25.9	24.5
10-Jul-01	82.0	79.7	77.4	27.8	26.5	25.2
11-Jul-01	80.4	79.0	78.1	26.9	26.1	25.6
12-Jul-01	82.0	78.9	76.1	27.8	26.1	24.5
13-Jul-01	81.5	79.8	77.7	27.5	26.5	25.4
14-Jul-01	79.9	77.9	75.9	26.6	25.5	24.4
15-Jul-01	77.2	74.0	72.0	25.1	23.3	22.2
16-Jul-01	72.7	70.4	68.9	22.6	21.3	20.5
17-Jul-01	70.5	68.7	66.6	21.4	20.4	19.2
18-Jul-01	71.4	69.1	66.9	21.9	20.6	19.4
19-Jul-01	73.6	71.2	68.5	23.1	21.8	20.3
20-Jul-01	74.1	73.0	72.0	23.4	22.8	22.2
21-Jul-01	75.0	72.3	70.0	23.9	22.4	21.1
22-Jul-01	75.9	73.6	71.4	24.4	23.1	21.9
23-Jul-01	78.6	75.9	73.2	25.9	24.4	22.9
24-Jul-01	80.2	77.7	75.6	26.8	25.4	24.2
25-Jul-01	79.9	77.4	75.2	26.6	25.2	24.0
26-Jul-01	79.9	77.3	75.0	26.6	25.1	23.9
27-Jul-01	78.1	74.9	73.2	25.6	23.8	22.9
28-Jul-01	75.2	72.7	71.4	24.0	22.6	21.9
29-Jul-01	71.2	68.7	67.1	21.8	20.4	19.5
30-Jul-01	68.0	66.8	65.8	20.0	19.3	18.8
31-Jul-01	70.3	67.1	64.9	21.3	19.5	18.3
1-Aug-01	72.9	70.6	68.5	22.7	21.4	20.3
2-Aug-01	76.1	72.9	70.9	24.5	22.7	21.6
3-Aug-01	78.3	75.5	73.8	25.7	24.2	23.2
4-Aug-01	75.6	73.9	73.2	24.2	23.3	22.9
5-Aug-01	75.0	71.4	70.0	23.9	21.9	21.1
6-Aug-01	79.2	75.1	72.7	26.2	23.9	22.6
7-Aug-01	81.1	78.6	76.5	27.3	25.9	24.7
8-Aug-01	80.2	77.8	75.9	26.8	25.5	24.4
9-Aug-01	78.6	76.1	74.1	25.9	24.5	23.4

DATE	Fahrenheit Maximum	Fahrenheit Average	Fahrenheit Minimum	Celsius Maximum	Celsius Average	Celsius Minimum
10-Aug-01	79.0	75.9	73.8	26.1	24.4	23.2
11-Aug-01	80.4	77.8	75.6	26.9	25.4	24.2
12-Aug-01	80.4	78.3	76.1	26.9	25.7	24.5
13-Aug-01	81.5	79.2	77.7	27.5	26.2	25.4
14-Aug-01	81.7	79.5	77.4	27.6	26.4	25.2
15-Aug-01	80.4	78.4	76.8	26.9	25.8	24.9
16-Aug-01	80.2	78.1	76.5	26.8	25.6	24.7
17-Aug-01	79.2	76.5	74.7	26.2	24.7	23.7
18-Aug-01	75.0	71.5	70.0	23.9	21.9	21.1
19-Aug-01	72.3	70.2	68.4	22.4	21.2	20.2
20-Aug-01	72.9	70.1	67.8	22.7	21.2	19.9
21-Aug-01	70.5	69.4	68.0	21.4	20.8	20.0
22-Aug-01	72.7	71.1	70.3	22.6	21.7	21.3
23-Aug-01	72.0	71.0	70.5	22.2	21.7	21.4
24-Aug-01	71.2	69.2	67.1	21.8	20.7	19.5
25-Aug-01	71.8	68.8	66.4	22.1	20.5	19.1
26-Aug-01	70.9	68.8	67.1	21.6	20.4	19.5
27-Aug-01	71.2	70.1	69.1	21.8	21.2	20.6
28-Aug-01	71.4	70.7	70.0	21.9	21.5	21.1
29-Aug-01	71.8	71.0	70.0	22.1	21.7	21.1
30-Aug-01	72.7	71.9	70.9	22.6	22.2	21.6
31-Aug-01	73.2	71.9	71.2	22.9	22.2	21.8
1-Sep-01	71.8	71.0	70.0	22.1	21.7	21.1
2-Sep-01	71.2	68.6	67.1	21.8	20.4	19.5
3-Sep-01	70.0	69.2	68.0	21.1	20.7	20.0
4-Sep-01	70.3	69.2	67.8	21.3	20.7	19.9
5-Sep-01	70.0	67.7	66.0	21.1	19.8	18.9
6-Sep-01	67.5	64.5	62.8	19.7	18.0	17.1
7-Sep-01	66.6	64.0	62.2	19.2	17.8	16.8
8-Sep-01	65.8	63.2	61.3	18.8	17.3	16.3
9-Sep-01	66.4	63.8	61.3	19.1	17.7	16.3
10-Sep-01	67.8	65.0	62.8	19.9	18.3	17.1
11-Sep-01	68.5	66.2	64.0	20.3	19.0	17.8
12-Sep-01	70.0	67.6	65.8	21.1	19.8	18.8
13-Sep-01	68.9	67.8	66.9	20.5	19.9	19.4
14-Sep-01	69.8	67.8	66.0	21.0	19.9	18.9
15-Sep-01	70.3	68.3	66.9	21.3	20.2	19.4
16-Sep-01	71.8	70.0	68.5	22.1	21.1	20.3
17-Sep-01	71.8	69.7	68.0	22.1	21.0	20.0
18-Sep-01	69.8	67.9	66.6	21.0	20.0	19.2
19-Sep-01	67.5	65.8	64.4	19.7	18.8	18.0
20-Sep-01	65.8	63.7	62.2	18.8	17.6	16.8
21-Sep-01	65.5	63.9	62.2	18.6	17.7	16.8
22-Sep-01	65.8	63.8	62.2	18.8	17.7	16.8
23-Sep-01	66.0	64.8	63.3	18.9	18.2	17.4
24-Sep-01	66.0	64.8	63.9	18.9	18.2	17.7
25-Sep-01	66.4	65.1	64.0	19.1	18.4	17.8
26-Sep-01	64.6	63.2	62.4	18.1	17.3	16.9

DATE	Fahrenheit Maximum	Fahrenheit Average	Fahrenheit Minimum	Celsius Maximum	Celsius Average	Celsius Minimum
27-Sep-01	63.9	62.8	61.9	17.7	17.1	16.6
28-Sep-01	63.5	61.9	60.3	17.5	16.6	15.7
29-Sep-01	61.7	60.7	59.2	16.5	15.9	15.1
30-Sep-01	61.3	59.9	58.1	16.3	15.5	14.5
1-Oct-01	61.7	59.9	58.1	16.5	15.5	14.5
2-Oct-01	61.3	60.2	58.6	16.3	15.7	14.8
3-Oct-01	60.8	59.4	58.1	16.0	15.2	14.5
4-Oct-01	59.9	58.3	56.8	15.5	14.6	13.8
5-Oct-01	57.6	56.3	54.9	14.2	13.5	12.7
6-Oct-01	56.8	55.2	53.8	13.8	12.9	12.1
7-Oct-01	54.9	54.3	53.6	12.7	12.4	12.0

Figure A-2: Maximum, minimum and average stream temperatures for the North Fork of the Walla Walla River (above the forks).

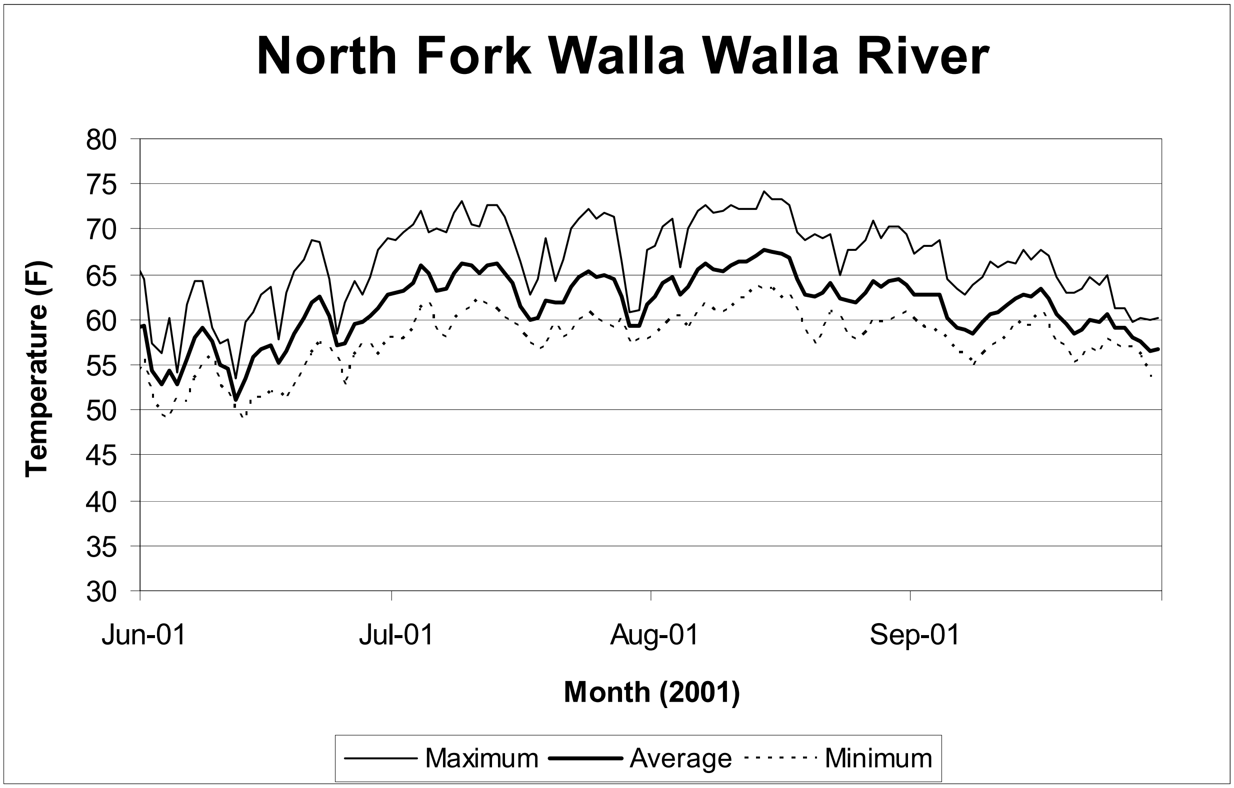


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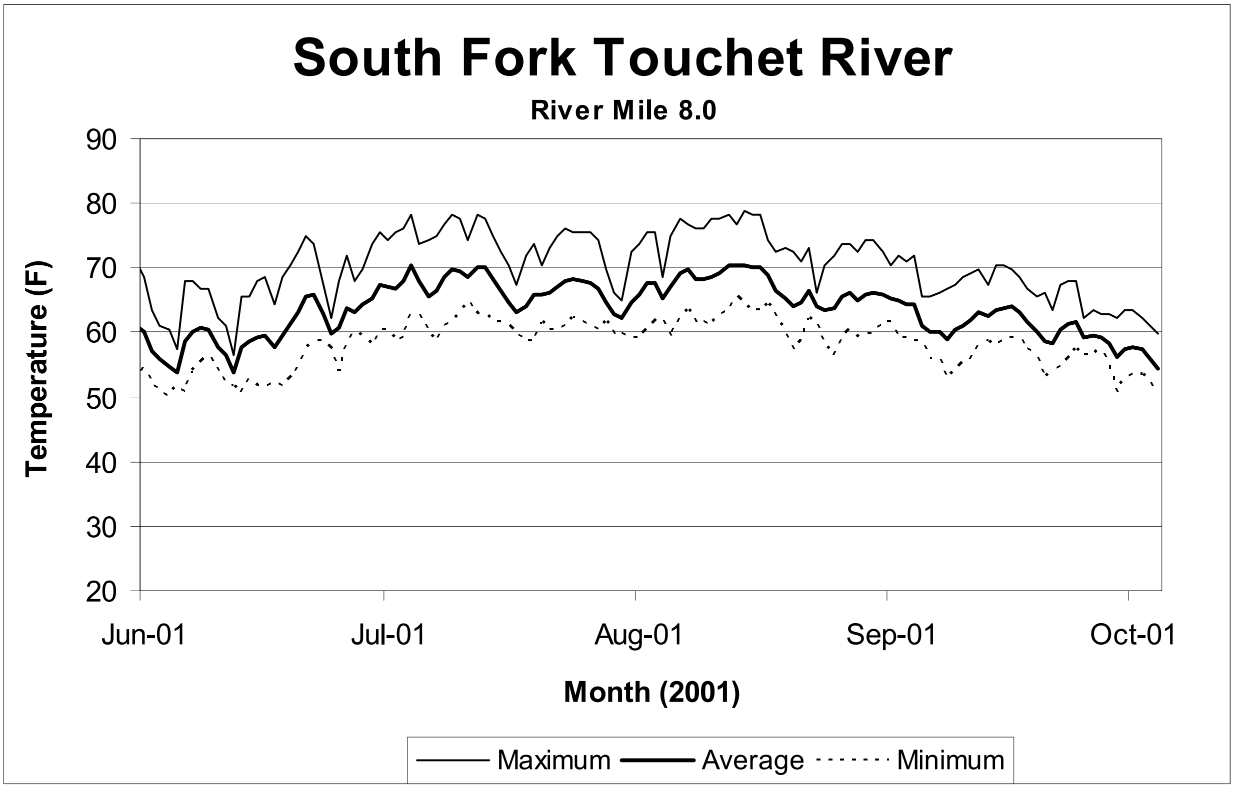
Table A-2: Water temperature data for the North Fork of the Walla Walla River (above forks) for May 31 through October 7, 2001.

	Fahrenheit			Celsius		
DATE	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	**Minimum**
31-May-01	66.2	59.2	53.1	19.0	15.1	11.7
1-Jun-01	64.4	59.2	55.6	18.0	15.1	13.1
2-Jun-01	57.4	54.3	51.4	14.1	12.4	10.8
3-Jun-01	56.3	52.8	49.5	13.5	11.5	9.7
4-Jun-01	60.3	54.3	49.3	15.7	12.4	9.6
5-Jun-01	54.1	52.8	51.4	12.3	11.6	10.8
6-Jun-01	61.7	55.7	50.9	16.5	13.1	10.5
7-Jun-01	64.2	58.0	53.4	17.9	14.4	11.9
8-Jun-01	64.2	59.1	55.2	17.9	15.1	12.9
9-Jun-01	59.2	57.6	56.1	15.1	14.2	13.4
10-Jun-01	57.4	54.9	52.7	14.1	12.7	11.5
11-Jun-01	57.7	54.6	52.2	14.3	12.5	11.2
12-Jun-01	53.4	51.2	49.8	11.9	10.7	9.9
13-Jun-01	59.7	53.5	48.9	15.4	12.0	9.4
14-Jun-01	60.8	55.9	51.6	16.0	13.3	10.9
15-Jun-01	62.8	56.7	51.4	17.1	13.7	10.8
16-Jun-01	63.7	57.2	52.0	17.6	14.0	11.1
17-Jun-01	57.7	55.1	52.0	14.3	12.8	11.1
18-Jun-01	63.0	56.5	51.1	17.2	13.6	10.6
19-Jun-01	65.3	58.5	52.7	18.5	14.7	11.5
20-Jun-01	66.7	60.2	54.7	19.3	15.7	12.6
21-Jun-01	68.7	62.0	56.3	20.4	16.6	13.5
22-Jun-01	68.5	62.5	57.4	20.3	16.9	14.1
23-Jun-01	64.4	60.4	56.8	18.0	15.8	13.8
24-Jun-01	58.5	57.1	55.8	14.7	14.0	13.2
25-Jun-01	61.9	57.4	52.7	16.6	14.1	11.5
26-Jun-01	64.2	59.4	56.1	17.9	15.2	13.4
27-Jun-01	62.8	59.7	57.4	17.1	15.4	14.1
28-Jun-01	64.8	60.5	57.4	18.2	15.8	14.1
29-Jun-01	67.6	61.3	56.1	19.8	16.3	13.4
30-Jun-01	69.1	62.8	57.9	20.6	17.1	14.4
1-Jul-01	68.7	62.9	57.9	20.4	17.2	14.4
2-Jul-01	69.6	63.1	57.7	20.9	17.3	14.3
3-Jul-01	70.5	64.1	58.8	21.4	17.9	14.9
4-Jul-01	72.0	66.1	61.3	22.2	18.9	16.3
5-Jul-01	69.6	65.0	61.9	20.9	18.4	16.6
6-Jul-01	70.0	63.2	58.8	21.1	17.3	14.9
7-Jul-01	69.6	63.5	57.9	20.9	17.5	14.4
8-Jul-01	71.8	65.2	59.9	22.1	18.5	15.5
9-Jul-01	73.0	66.1	60.8	22.8	19.0	16.0
10-Jul-01	70.5	65.9	61.3	21.4	18.8	16.3
11-Jul-01	70.3	65.2	62.2	21.3	18.5	16.8
12-Jul-01	72.7	66.0	61.7	22.6	18.9	16.5
13-Jul-01	72.7	66.1	61.0	22.6	18.9	16.1
14-Jul-01	71.4	65.2	60.3	21.9	18.5	15.7

		Fahrenheit			Celsius	
DATE	Maximum	Average	Minimum	Maximum	Average	Minimum
15-Jul-01	69.1	64.0	59.9	20.6	17.8	15.5
16-Jul-01	66.4	61.5	58.8	19.1	16.4	14.9
17-Jul-01	62.8	59.9	57.4	17.1	15.5	14.1
18-Jul-01	64.4	60.2	56.7	18.0	15.6	13.7
19-Jul-01	69.1	62.2	56.8	20.6	16.8	13.8
20-Jul-01	64.2	62.0	59.7	17.9	16.6	15.4
21-Jul-01	66.7	61.9	57.9	19.3	16.6	14.4
22-Jul-01	70.0	63.5	58.5	21.1	17.5	14.7
23-Jul-01	71.1	64.7	59.9	21.7	18.2	15.5
24-Jul-01	72.3	65.4	60.8	22.4	18.6	16.0
25-Jul-01	71.1	64.7	59.9	21.7	18.2	15.5
26-Jul-01	71.8	64.9	59.7	22.1	18.3	15.4
27-Jul-01	71.4	64.5	59.2	21.9	18.0	15.1
28-Jul-01	66.4	62.5	60.3	19.1	17.0	15.7
29-Jul-01	60.8	59.3	57.4	16.0	15.2	14.1
30-Jul-01	61.0	59.2	57.7	16.1	15.1	14.3
31-Jul-01	67.8	61.7	57.7	19.9	16.5	14.3
1-Aug-01	68.2	62.5	58.3	20.1	17.0	14.6
2-Aug-01	70.3	64.0	59.2	21.3	17.8	15.1
3-Aug-01	71.1	64.7	60.3	21.7	18.1	15.7
4-Aug-01	65.8	62.8	60.4	18.8	17.1	15.8
5-Aug-01	70.0	63.6	58.8	21.1	17.6	14.9
6-Aug-01	72.0	65.6	60.8	22.2	18.6	16.0
7-Aug-01	72.7	66.2	61.9	22.6	19.0	16.6
8-Aug-01	71.8	65.6	61.0	22.1	18.7	16.1
9-Aug-01	72.0	65.3	60.8	22.2	18.5	16.0
10-Aug-01	72.7	66.0	61.0	22.6	18.9	16.1
11-Aug-01	72.3	66.4	62.2	22.4	19.1	16.8
12-Aug-01	72.3	66.4	62.4	22.4	19.1	16.9
13-Aug-01	72.3	67.1	63.9	22.4	19.5	17.7
14-Aug-01	74.1	67.8	63.3	23.4	19.9	17.4
15-Aug-01	73.2	67.5	63.3	22.9	19.7	17.4
16-Aug-01	73.2	67.2	62.4	22.9	19.5	16.9
17-Aug-01	72.7	66.7	62.8	22.6	19.3	17.1
18-Aug-01	69.6	64.4	61.0	20.9	18.0	16.1
19-Aug-01	68.7	62.8	58.8	20.4	17.1	14.9
20-Aug-01	69.4	62.6	57.4	20.8	17.0	14.1
21-Aug-01	69.1	63.0	58.5	20.6	17.2	14.7
22-Aug-01	69.4	64.0	60.8	20.8	17.8	16.0
23-Aug-01	64.9	62.3	60.4	18.3	16.8	15.8
24-Aug-01	67.8	62.2	58.3	19.9	16.8	14.6
25-Aug-01	67.8	62.0	57.7	19.9	16.7	14.3
26-Aug-01	68.7	63.0	58.5	20.4	17.2	14.7
27-Aug-01	70.9	64.4	60.3	21.6	18.0	15.7
28-Aug-01	69.1	63.5	59.7	20.6	17.5	15.4
29-Aug-01	70.3	64.3	59.9	21.3	17.9	15.5
30-Aug-01	70.3	64.6	60.4	21.3	18.1	15.8
31-Aug-01	69.4	63.9	60.8	20.8	17.7	16.0

DATE	Fahrenheit Maximum	Fahrenheit Average	Fahrenheit Minimum	Celsius Maximum	Celsius Average	Celsius Minimum
1-Sep-01	67.3	62.8	59.9	19.6	17.1	15.5
2-Sep-01	68.2	62.8	59.2	20.1	17.1	15.1
3-Sep-01	68.2	62.9	59.2	20.1	17.1	15.1
4-Sep-01	68.7	62.8	58.5	20.4	17.1	14.7
5-Sep-01	64.4	60.3	57.7	18.0	15.7	14.3
6-Sep-01	63.3	59.2	56.3	17.4	15.1	13.5
7-Sep-01	62.8	58.9	56.3	17.1	14.9	13.5
8-Sep-01	63.9	58.5	54.7	17.7	14.7	12.6
9-Sep-01	64.8	59.7	56.1	18.2	15.4	13.4
10-Sep-01	66.4	60.7	56.8	19.1	15.9	13.8
11-Sep-01	65.8	60.9	57.4	18.8	16.1	14.1
12-Sep-01	66.4	61.6	58.3	19.1	16.5	14.6
13-Sep-01	66.2	62.3	59.9	19.0	16.8	15.5
14-Sep-01	67.6	62.7	59.4	19.8	17.0	15.2
15-Sep-01	66.7	62.5	59.4	19.3	17.0	15.2
16-Sep-01	67.6	63.5	61.0	19.8	17.5	16.1
17-Sep-01	67.1	62.4	59.4	19.5	16.9	15.2
18-Sep-01	64.8	60.6	57.4	18.2	15.9	14.1
19-Sep-01	63.0	59.5	57.2	17.2	15.3	14.0
20-Sep-01	63.0	58.5	55.2	17.2	14.7	12.9
21-Sep-01	63.3	58.8	55.8	17.4	14.9	13.2
22-Sep-01	64.8	59.9	56.8	18.2	15.5	13.8
23-Sep-01	63.9	59.7	56.3	17.7	15.4	13.5
24-Sep-01	64.9	60.7	57.7	18.3	15.9	14.3
25-Sep-01	61.3	59.2	57.2	16.3	15.1	14.0
26-Sep-01	61.3	59.1	56.8	16.3	15.0	13.8
27-Sep-01	59.7	57.9	56.8	15.4	14.4	13.8
28-Sep-01	60.3	57.6	56.1	15.7	14.2	13.4
29-Sep-01	59.9	56.4	53.6	15.5	13.6	12.0
30-Sep-01	60.3	56.6	53.6	15.7	13.7	12.0
1-Oct-01	61.7	57.6	54.7	16.5	14.2	12.6
2-Oct-01	60.4	57.5	55.2	15.8	14.2	12.9
3-Oct-01	59.4	56.3	54.1	15.2	13.5	12.3
4-Oct-01	57.4	54.8	52.5	14.1	12.7	11.4
5-Oct-01	56.3	53.3	50.5	13.5	11.8	10.3
6-Oct-01	57.4	53.9	51.4	14.1	12.2	10.8
7-Oct-01	55.8	53.7	51.6	13.2	12.1	10.9

Figure A-3: Maximum, minimum and average stream temperatures for the South Fork of the Touchet River (RM 8.0).



File Name: SF Touchet (RM8) – 2001.xls

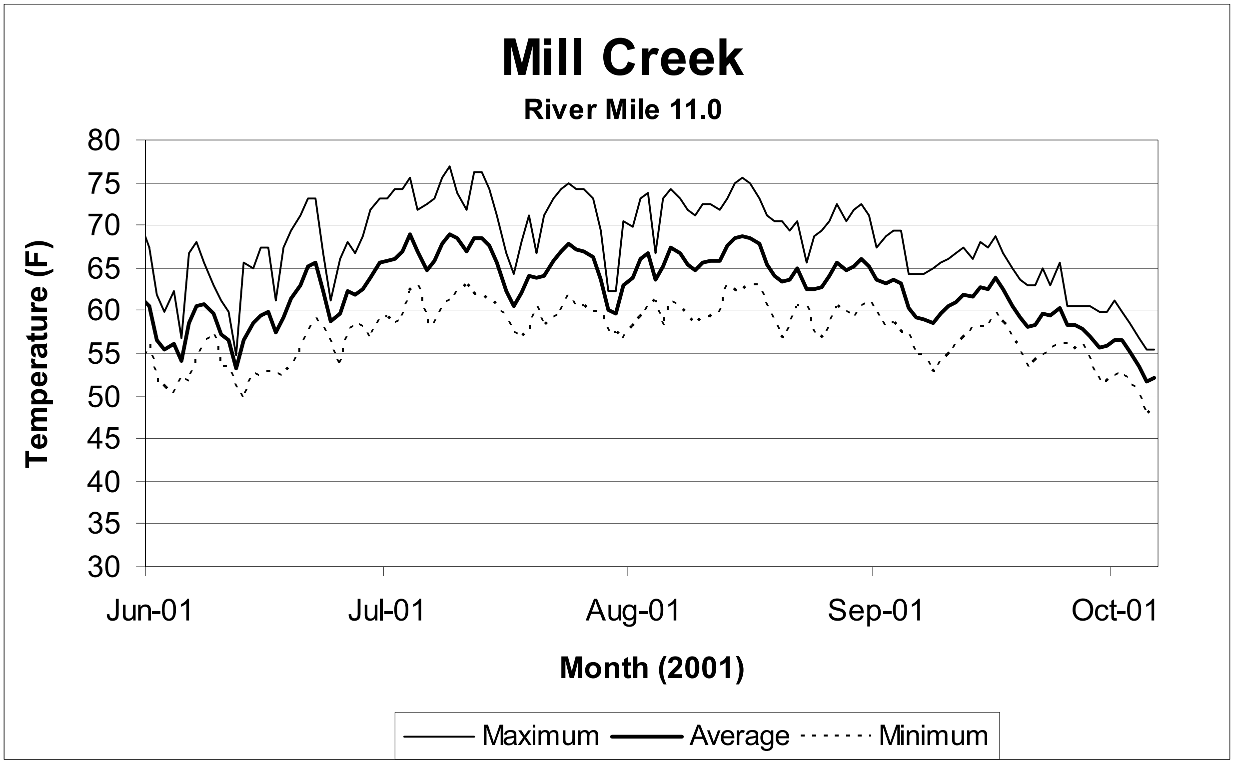
Table A-3: Water temperature data for the South Fork Touchet River at River Mile 8.0 for May 31 through October 4, 2001.

	Fahrenheit			Celsius		
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
31-May-01	71.1	60.9	52.2	21.7	16.1	11.2
1-Jun-01	68.6	60.2	54.7	20.3	15.7	12.6
2-Jun-01	63.6	57.0	52.2	17.6	13.9	11.2
3-Jun-01	61.1	55.8	50.9	16.2	13.2	10.5
4-Jun-01	60.4	54.8	50.3	15.8	12.6	10.1
5-Jun-01	57.3	53.9	51.5	14.0	12.2	10.9
6-Jun-01	68.0	58.6	50.9	20.0	14.8	10.5
7-Jun-01	68.0	60.1	54.1	20.0	15.6	12.3
8-Jun-01	66.7	60.6	55.4	19.3	15.9	13.0
9-Jun-01	66.7	60.5	56.7	19.3	15.8	13.7
10-Jun-01	62.3	57.8	54.1	16.9	14.3	12.3
11-Jun-01	61.1	56.5	52.2	16.2	13.6	11.2
12-Jun-01	56.7	53.9	51.5	13.7	12.2	10.9
13-Jun-01	65.5	57.6	50.9	18.6	14.2	10.5
14-Jun-01	65.5	58.7	52.8	18.6	14.8	11.6
15-Jun-01	68.0	59.3	51.5	20.0	15.2	10.9
16-Jun-01	68.6	59.4	51.5	20.3	15.2	10.9
17-Jun-01	64.2	57.8	52.2	17.9	14.3	11.2
18-Jun-01	68.6	59.5	51.5	20.3	15.3	10.9
19-Jun-01	70.5	61.2	52.8	21.4	16.2	11.6
20-Jun-01	72.4	63.1	54.7	22.4	17.3	12.6
21-Jun-01	74.9	65.5	57.3	23.8	18.6	14.0
22-Jun-01	73.7	66.0	58.6	23.1	18.9	14.8
23-Jun-01	67.4	62.9	58.6	19.7	17.2	14.8
24-Jun-01	62.3	59.7	57.3	16.9	15.4	14.0
25-Jun-01	68.0	60.9	54.1	20.0	16.0	12.3
26-Jun-01	71.8	63.7	57.9	22.1	17.6	14.4
27-Jun-01	68.0	63.2	60.4	20.0	17.4	15.8
28-Jun-01	69.9	64.3	59.2	21.0	17.9	15.1
29-Jun-01	73.7	65.3	57.9	23.1	18.5	14.4
30-Jun-01	75.6	67.2	60.4	24.2	19.6	15.8
1-Jul-01	74.3	67.2	60.4	23.5	19.5	15.8
2-Jul-01	75.6	66.7	58.6	24.2	19.3	14.8
3-Jul-01	76.2	67.8	59.2	24.6	19.9	15.1
4-Jul-01	78.2	70.5	63.0	25.6	21.4	17.2
5-Jul-01	73.7	68.1	63.0	23.1	20.0	17.2
6-Jul-01	74.3	65.5	59.8	23.5	18.6	15.5
7-Jul-01	74.9	66.6	58.6	23.8	19.2	14.8
8-Jul-01	76.9	68.7	61.1	24.9	20.4	16.2
9-Jul-01	78.2	69.9	61.7	25.6	21.1	16.5
10-Jul-01	77.5	69.6	63.0	25.3	20.9	17.2
11-Jul-01	74.3	68.4	64.9	23.5	20.2	18.3
12-Jul-01	78.2	70.2	63.0	25.6	21.2	17.2
13-Jul-01	77.5	69.9	63.0	25.3	21.1	17.2
14-Jul-01	74.9	68.3	61.7	23.8	20.2	16.5

		Fahrenheit			Celsius	
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
15-Jul-01	72.4	66.5	61.7	22.4	19.2	16.5
16-Jul-01	70.5	64.7	61.1	21.4	18.2	16.2
17-Jul-01	67.4	63.0	59.8	19.7	17.2	15.5
18-Jul-01	71.8	64.1	58.6	22.1	17.9	14.8
19-Jul-01	73.7	65.8	58.6	23.1	18.8	14.8
20-Jul-01	70.5	65.8	61.7	21.4	18.8	16.5
21-Jul-01	73.0	66.1	60.4	22.8	18.9	15.8
22-Jul-01	74.9	67.1	60.4	23.8	19.5	15.8
23-Jul-01	76.2	68.0	61.1	24.6	20.0	16.2
24-Jul-01	75.6	68.4	62.3	24.2	20.2	16.9
25-Jul-01	75.6	68.1	61.7	24.2	20.0	16.5
26-Jul-01	75.6	67.7	61.1	24.2	19.8	16.2
27-Jul-01	74.3	66.8	60.4	23.5	19.4	15.8
28-Jul-01	69.9	64.7	61.7	21.0	18.1	16.5
29-Jul-01	66.1	62.7	59.8	19.0	17.1	15.5
30-Jul-01	64.9	62.2	59.8	18.3	16.8	15.5
31-Jul-01	72.4	64.7	59.2	22.4	18.2	15.1
1-Aug-01	73.7	65.8	59.2	23.1	18.8	15.1
2-Aug-01	75.6	67.7	60.4	24.2	19.8	15.8
3-Aug-01	75.6	67.8	61.7	24.2	19.9	16.5
4-Aug-01	68.6	65.2	62.3	20.3	18.5	16.9
5-Aug-01	74.9	67.0	59.2	23.8	19.4	15.1
6-Aug-01	77.5	69.2	62.3	25.3	20.7	16.9
7-Aug-01	76.9	69.7	63.6	24.9	20.9	17.6
8-Aug-01	76.2	68.4	61.7	24.6	20.2	16.5
9-Aug-01	76.2	68.1	61.7	24.6	20.1	16.5
10-Aug-01	77.5	68.6	61.1	25.3	20.3	16.2
11-Aug-01	77.5	69.3	63.0	25.3	20.7	17.2
12-Aug-01	78.2	70.3	63.6	25.6	21.3	17.6
13-Aug-01	76.9	70.5	65.5	24.9	21.4	18.6
14-Aug-01	78.8	70.4	64.2	26.0	21.4	17.9
15-Aug-01	78.2	70.1	63.6	25.6	21.2	17.6
16-Aug-01	78.2	69.9	63.6	25.6	21.1	17.6
17-Aug-01	74.3	69.0	64.2	23.5	20.5	17.9
18-Aug-01	72.4	66.5	62.3	22.4	19.2	16.9
19-Aug-01	73.0	65.3	59.8	22.8	18.5	15.5
20-Aug-01	72.4	64.1	57.3	22.4	17.8	14.0
21-Aug-01	71.1	64.6	58.6	21.7	18.1	14.8
22-Aug-01	73.0	66.4	62.3	22.8	19.1	16.9
23-Aug-01	66.1	64.1	61.7	19.0	17.9	16.5
24-Aug-01	70.5	63.5	57.9	21.4	17.5	14.4
25-Aug-01	71.8	63.8	56.7	22.1	17.6	13.7
26-Aug-01	73.7	65.6	59.2	23.1	18.7	15.1
27-Aug-01	73.7	66.2	60.4	23.1	19.0	15.8
28-Aug-01	72.4	65.1	59.2	22.4	18.4	15.1
29-Aug-01	74.3	65.9	59.8	23.5	18.8	15.5
30-Aug-01	74.3	66.2	59.8	23.5	19.0	15.5
31-Aug-01	72.4	65.8	61.7	22.4	18.8	16.5

		Fahrenheit			Celsius	
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
1-Sep-01	70.5	65.2	61.7	21.4	18.5	16.5
2-Sep-01	71.8	65.0	59.2	22.1	18.3	15.1
3-Sep-01	71.1	64.4	59.2	21.7	18.0	15.1
4-Sep-01	71.8	64.2	58.6	22.1	17.9	14.8
5-Sep-01	65.5	61.0	58.6	18.6	16.1	14.8
6-Sep-01	65.5	60.1	56.0	18.6	15.6	13.3
7-Sep-01	66.1	60.0	56.0	19.0	15.5	13.3
8-Sep-01	66.7	59.0	52.8	19.3	15.0	11.6
9-Sep-01	67.4	60.3	54.1	19.7	15.7	12.3
10-Sep-01	68.6	61.2	55.4	20.3	16.2	13.0
11-Sep-01	69.3	61.9	56.0	20.7	16.6	13.3
12-Sep-01	69.9	63.2	57.9	21.0	17.3	14.4
13-Sep-01	67.4	62.5	58.6	19.7	16.9	14.8
14-Sep-01	70.5	63.4	57.9	21.4	17.4	14.4
15-Sep-01	70.5	63.6	58.6	21.4	17.6	14.8
16-Sep-01	69.9	63.9	59.2	21.0	17.7	15.1
17-Sep-01	68.6	63.3	59.2	20.3	17.4	15.1
18-Sep-01	66.7	61.6	57.3	19.3	16.5	14.0
19-Sep-01	65.5	60.1	56.7	18.6	15.6	13.7
20-Sep-01	66.1	58.8	52.8	19.0	14.9	11.6
21-Sep-01	63.6	58.5	54.1	17.6	14.7	12.3
22-Sep-01	67.4	60.4	54.7	19.7	15.8	12.6
23-Sep-01	68.0	61.4	56.0	20.0	16.3	13.3
24-Sep-01	68.0	61.8	57.3	20.0	16.5	14.0
25-Sep-01	62.3	59.2	56.7	16.9	15.1	13.7
26-Sep-01	63.6	59.6	56.7	17.6	15.3	13.7
27-Sep-01	63.0	59.4	57.3	17.2	15.2	14.0
28-Sep-01	63.0	58.5	54.7	17.2	14.7	12.6
29-Sep-01	62.3	56.1	50.9	16.9	13.4	10.5
30-Sep-01	63.6	57.3	52.8	17.6	14.0	11.6
1-Oct-01	63.6	57.8	53.5	17.6	14.3	11.9
2-Oct-01	62.3	57.4	53.5	16.9	14.1	11.9
3-Oct-01	61.1	55.9	52.2	16.2	13.3	11.2
4-Oct-01	59.8	54.5	50.9	15.5	12.5	10.5

Figure A-4: Maximum, minimum and average stream temperatures for Mill Creek (RM 11.0).



File Name: Mill (RM11) – 2001.xls

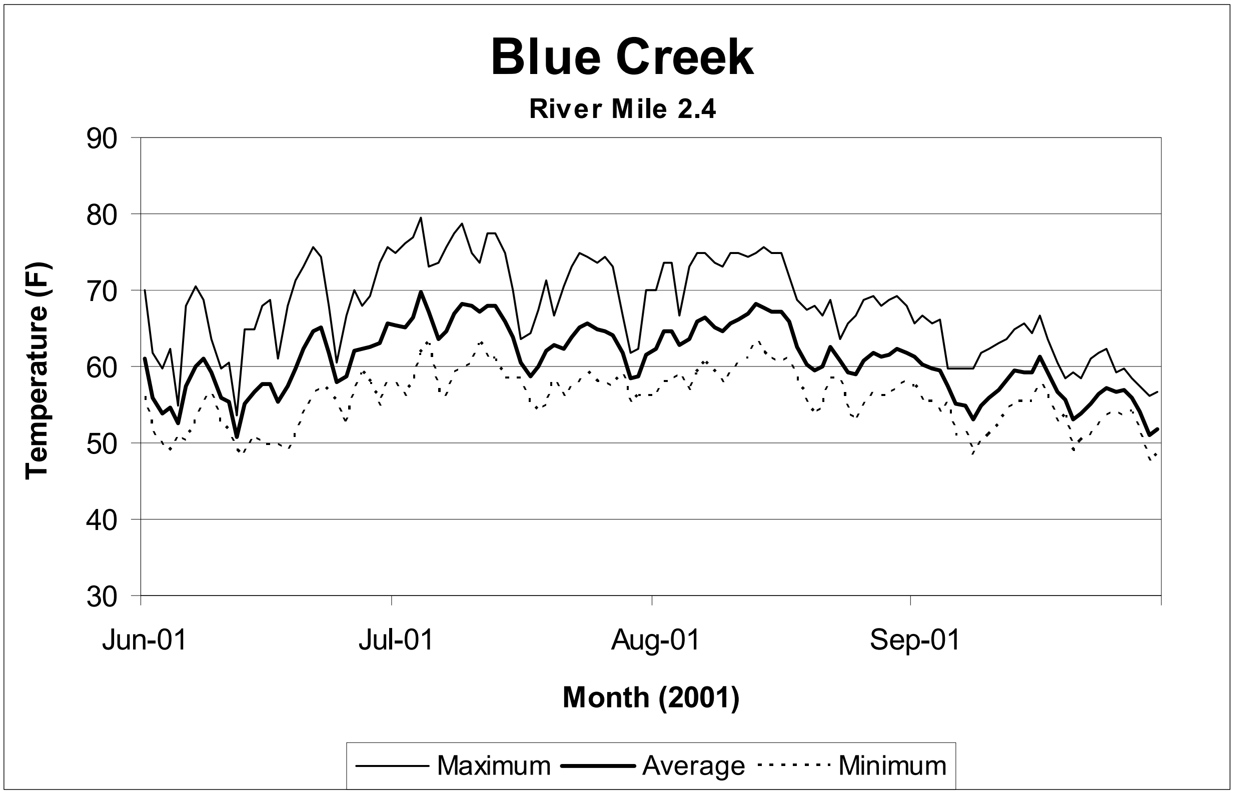
Table A-4: Water temperature data for Mill Creek at River Mile 11.0 for May 31 through October 6, 2001.

	Fahrenheit			Celsius		
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
31-May-01	69.9	61.4	53.5	21.1	16.3	12.0
1-Jun-01	67.4	60.4	56.1	19.7	15.8	13.4
2-Jun-01	61.8	56.6	51.6	16.5	13.7	10.9
3-Jun-01	59.9	55.4	51.0	15.5	13.0	10.5
4-Jun-01	62.4	56.1	50.3	16.9	13.4	10.2
5-Jun-01	56.7	54.2	52.3	13.7	12.3	11.3
6-Jun-01	66.8	58.6	51.6	19.3	14.8	10.9
7-Jun-01	68.1	60.6	54.2	20.0	15.9	12.3
8-Jun-01	65.5	60.8	56.1	18.6	16.0	13.4
9-Jun-01	63.0	59.6	57.3	17.2	15.3	14.1
10-Jun-01	61.1	57.2	53.5	16.2	14.0	12.0
11-Jun-01	59.9	56.6	53.5	15.5	13.7	12.0
12-Jun-01	54.8	53.1	51.0	12.7	11.7	10.5
13-Jun-01	65.5	56.6	49.7	18.6	13.6	9.8
14-Jun-01	64.9	58.5	52.9	18.3	14.7	11.6
15-Jun-01	67.4	59.5	52.3	19.7	15.3	11.3
16-Jun-01	67.4	59.9	52.9	19.7	15.5	11.6
17-Jun-01	61.1	57.4	52.9	16.2	14.1	11.6
18-Jun-01	67.4	59.3	52.3	19.7	15.2	11.3
19-Jun-01	69.3	61.3	53.5	20.7	16.3	12.0
20-Jun-01	71.2	63.1	55.5	21.8	17.3	13.0
21-Jun-01	73.1	65.1	57.3	22.8	18.4	14.1
22-Jun-01	73.1	65.6	59.3	22.8	18.7	15.1
23-Jun-01	66.8	62.3	58.0	19.3	16.8	14.4
24-Jun-01	61.1	58.7	56.1	16.2	14.8	13.4
25-Jun-01	66.2	59.7	53.5	19.0	15.4	12.0
26-Jun-01	68.1	62.2	57.3	20.0	16.8	14.1
27-Jun-01	66.8	62.0	58.6	19.3	16.6	14.8
28-Jun-01	68.7	62.6	58.0	20.4	17.0	14.4
29-Jun-01	71.8	63.9	56.7	22.1	17.7	13.7
30-Jun-01	73.1	65.6	59.3	22.8	18.7	15.1
1-Jul-01	73.1	65.8	59.3	22.8	18.8	15.1
2-Jul-01	74.3	66.1	58.6	23.5	18.9	14.8
3-Jul-01	74.3	67.0	59.3	23.5	19.5	15.1
4-Jul-01	75.6	69.0	62.4	24.2	20.5	16.9
5-Jul-01	71.8	67.1	63.0	22.1	19.5	17.2
6-Jul-01	72.4	64.8	58.6	22.5	18.2	14.8
7-Jul-01	73.1	65.8	58.6	22.8	18.8	14.8
8-Jul-01	75.6	67.8	60.5	24.2	19.9	15.8
9-Jul-01	76.9	68.9	61.1	25.0	20.5	16.2
10-Jul-01	73.7	68.5	62.4	23.2	20.3	16.9
11-Jul-01	71.8	66.9	63.0	22.1	19.4	17.2
12-Jul-01	76.3	68.4	61.8	24.6	20.2	16.5
13-Jul-01	76.3	68.6	61.8	24.6	20.3	16.5
14-Jul-01	74.3	67.5	61.1	23.5	19.7	16.2

		Fahrenheit			Celsius	
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
15-Jul-01	71.2	65.7	60.5	21.8	18.7	15.8
16-Jul-01	66.8	62.3	59.3	19.3	16.8	15.1
17-Jul-01	64.3	60.6	57.3	17.9	15.9	14.1
18-Jul-01	68.1	62.1	56.7	20.0	16.7	13.7
19-Jul-01	71.2	64.1	57.3	21.8	17.9	14.1
20-Jul-01	66.8	63.9	60.5	19.3	17.7	15.8
21-Jul-01	71.2	64.0	58.0	21.8	17.8	14.4
22-Jul-01	73.1	65.9	59.3	22.8	18.8	15.1
23-Jul-01	74.3	67.0	59.9	23.5	19.4	15.5
24-Jul-01	75.0	67.8	61.8	23.9	19.9	16.5
25-Jul-01	74.3	67.1	60.5	23.5	19.5	15.8
26-Jul-01	74.3	66.9	60.5	23.5	19.4	15.8
27-Jul-01	73.1	66.2	59.9	22.8	19.0	15.5
28-Jul-01	69.3	63.7	59.9	20.7	17.6	15.5
29-Jul-01	62.4	60.0	57.3	16.9	15.5	14.1
30-Jul-01	62.4	59.6	57.3	16.9	15.4	14.1
31-Jul-01	70.6	63.0	56.7	21.4	17.2	13.7
1-Aug-01	69.9	63.9	58.0	21.1	17.7	14.4
2-Aug-01	73.1	66.0	59.3	22.8	18.9	15.1
3-Aug-01	73.7	66.7	60.5	23.2	19.3	15.8
4-Aug-01	66.8	63.6	61.1	19.3	17.6	16.2
5-Aug-01	73.1	65.2	58.0	22.8	18.5	14.4
6-Aug-01	74.3	67.4	61.1	23.5	19.7	16.2
7-Aug-01	73.1	66.7	60.5	22.8	19.3	15.8
8-Aug-01	71.8	65.3	59.3	22.1	18.5	15.1
9-Aug-01	71.2	64.8	58.6	21.8	18.2	14.8
10-Aug-01	72.4	65.6	59.3	22.5	18.7	15.1
11-Aug-01	72.4	65.8	59.3	22.5	18.8	15.1
12-Aug-01	71.8	65.9	59.9	22.1	18.9	15.5
13-Aug-01	73.1	67.7	63.0	22.8	19.8	17.2
14-Aug-01	75.0	68.5	62.4	23.9	20.3	16.9
15-Aug-01	75.6	68.7	62.4	24.2	20.4	16.9
16-Aug-01	75.0	68.6	63.0	23.9	20.3	17.2
17-Aug-01	73.1	67.8	63.0	22.8	19.9	17.2
18-Aug-01	71.2	65.3	60.5	21.8	18.5	15.8
19-Aug-01	70.6	64.0	58.6	21.4	17.8	14.8
20-Aug-01	70.6	63.4	56.7	21.4	17.5	13.7
21-Aug-01	69.3	63.6	58.0	20.7	17.6	14.4
22-Aug-01	70.6	64.9	60.5	21.4	18.3	15.8
23-Aug-01	65.5	62.6	60.5	18.6	17.0	15.8
24-Aug-01	68.7	62.6	57.3	20.4	17.0	14.1
25-Aug-01	69.3	62.8	56.7	20.7	17.1	13.7
26-Aug-01	70.6	64.0	58.0	21.4	17.8	14.4
27-Aug-01	72.4	65.6	60.5	22.5	18.7	15.8
28-Aug-01	70.6	64.6	59.9	21.4	18.1	15.5
29-Aug-01	71.8	65.1	59.3	22.1	18.4	15.1
30-Aug-01	72.4	66.0	60.5	22.5	18.9	15.8
31-Aug-01	71.2	65.3	61.1	21.8	18.5	16.2

		Fahrenheit			Celsius	
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
1-Sep-01	67.4	63.7	59.9	19.7	17.6	15.5
2-Sep-01	68.7	63.3	58.0	20.4	17.4	14.4
3-Sep-01	69.3	63.6	58.6	20.7	17.6	14.8
4-Sep-01	69.3	63.3	57.3	20.7	17.4	14.1
5-Sep-01	64.3	60.4	57.3	17.9	15.8	14.1
6-Sep-01	64.3	59.3	54.8	17.9	15.1	12.7
7-Sep-01	64.3	58.9	54.8	17.9	15.0	12.7
8-Sep-01	64.9	58.6	52.9	18.3	14.8	11.6
9-Sep-01	65.5	59.7	54.2	18.6	15.4	12.3
10-Sep-01	66.2	60.6	54.8	19.0	15.9	12.7
11-Sep-01	66.8	61.0	56.1	19.3	16.1	13.4
12-Sep-01	67.4	61.9	56.7	19.7	16.6	13.7
13-Sep-01	66.2	61.6	58.0	19.0	16.5	14.4
14-Sep-01	68.1	62.7	58.0	20.0	17.0	14.4
15-Sep-01	67.4	62.5	58.0	19.7	17.0	14.4
16-Sep-01	68.7	63.8	59.9	20.4	17.7	15.5
17-Sep-01	66.8	62.5	58.6	19.3	16.9	14.8
18-Sep-01	64.9	60.5	56.7	18.3	15.9	13.7
19-Sep-01	63.7	59.2	55.5	17.6	15.1	13.0
20-Sep-01	63.0	58.2	53.5	17.2	14.5	12.0
21-Sep-01	63.0	58.3	54.2	17.2	14.6	12.3
22-Sep-01	64.9	59.6	54.8	18.3	15.3	12.7
23-Sep-01	63.0	59.4	55.5	17.2	15.2	13.0
24-Sep-01	65.5	60.4	56.1	18.6	15.8	13.4
25-Sep-01	60.5	58.4	56.1	15.8	14.7	13.4
26-Sep-01	60.5	58.3	55.5	15.8	14.6	13.0
27-Sep-01	60.5	57.9	56.1	15.8	14.4	13.4
28-Sep-01	60.5	57.0	54.2	15.8	13.9	12.3
29-Sep-01	59.9	55.8	51.6	15.5	13.2	10.9
30-Sep-01	59.9	55.8	51.6	15.5	13.2	10.9
1-Oct-01	61.1	56.6	52.3	16.2	13.6	11.3
2-Oct-01	59.9	56.5	52.9	15.5	13.6	11.6
3-Oct-01	58.6	55.2	51.6	14.8	12.9	10.9
4-Oct-01	56.7	53.4	50.3	13.7	11.9	10.2
5-Oct-01	55.5	51.7	47.7	13.0	11.0	8.7
6-Oct-01	55.5	52.1	48.4	13.0	11.1	9.1

Figure A-5: Maximum, minimum and average stream temperatures for Blue Creek (RM 2.4).



File Name: Blue (RM2.4) – 2001.xls

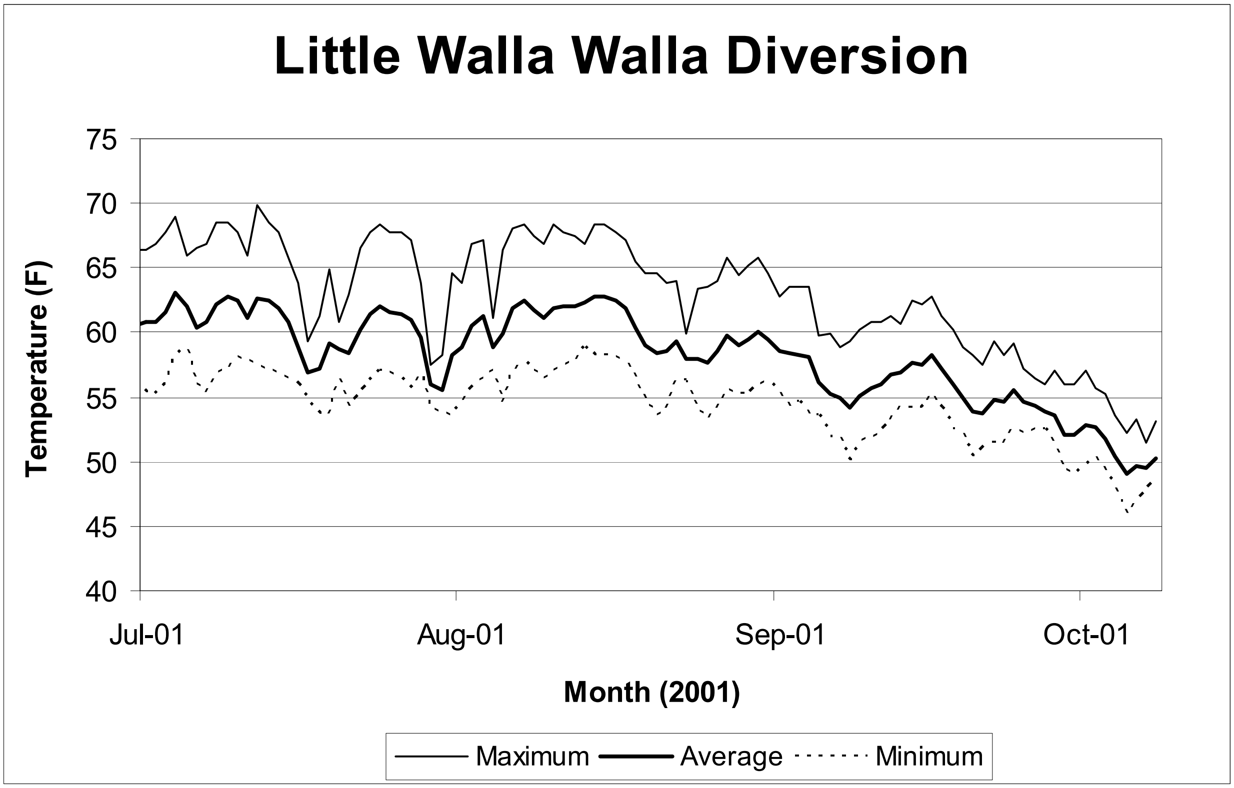
Table A-5: Water temperature data for Blue Creek at River Mile 2.4 for June 1 through October 6, 2001.

		Fahrenheit			**Celsius**	
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
1-Jun-01	69.9	60.9	56.0	21.1	16.1	13.4
2-Jun-01	61.7	55.8	51.6	16.5	13.2	10.9
3-Jun-01	59.8	54.0	49.7	15.5	12.2	9.8
4-Jun-01	62.4	54.5	49.0	16.9	12.5	9.4
5-Jun-01	54.8	52.7	50.9	12.7	11.5	10.5
6-Jun-01	68.0	57.5	50.3	20.0	14.2	10.2
7-Jun-01	70.5	60.1	52.9	21.4	15.6	11.6
8-Jun-01	68.6	61.0	55.4	20.4	16.1	13.0
9-Jun-01	63.6	59.3	56.7	17.6	15.2	13.7
10-Jun-01	59.8	55.9	52.2	15.5	13.3	11.2
11-Jun-01	60.5	55.5	51.6	15.8	13.0	10.9
12-Jun-01	53.5	50.8	49.0	11.9	10.4	9.4
13-Jun-01	64.9	55.2	48.3	18.3	12.9	9.1
14-Jun-01	64.9	56.8	50.9	18.3	13.8	10.5
15-Jun-01	68.0	57.6	49.7	20.0	14.2	9.8
16-Jun-01	68.6	57.8	49.7	20.4	14.3	9.8
17-Jun-01	61.1	55.5	49.7	16.2	13.1	9.8
18-Jun-01	68.0	57.3	49.0	20.0	14.1	9.4
19-Jun-01	71.2	59.8	50.9	21.8	15.5	10.5
20-Jun-01	73.0	62.2	53.5	22.8	16.8	11.9
21-Jun-01	75.6	64.6	56.0	24.2	18.1	13.4
22-Jun-01	74.3	65.2	57.3	23.5	18.4	14.1
23-Jun-01	68.0	61.7	56.7	20.0	16.5	13.7
24-Jun-01	60.5	58.0	55.4	15.8	14.4	13.0
25-Jun-01	66.8	58.8	52.2	19.3	14.9	11.2
26-Jun-01	69.9	62.0	56.7	21.1	16.7	13.7
27-Jun-01	68.0	62.4	59.2	20.0	16.9	15.1
28-Jun-01	69.3	62.6	58.0	20.7	17.0	14.4
29-Jun-01	73.7	63.0	54.8	23.2	17.2	12.7
30-Jun-01	75.6	65.6	58.0	24.2	18.7	14.4
1-Jul-01	74.9	65.5	58.0	23.9	18.6	14.4
2-Jul-01	76.2	65.1	56.0	24.6	18.4	13.4
3-Jul-01	76.9	66.5	58.0	24.9	19.2	14.4
4-Jul-01	79.4	69.7	61.7	26.4	20.9	16.5
5-Jul-01	73.0	67.3	63.0	22.8	19.6	17.2
6-Jul-01	73.7	63.6	56.7	23.2	17.5	13.7
7-Jul-01	75.6	64.6	56.0	24.2	18.1	13.4
8-Jul-01	77.5	67.0	59.2	25.3	19.4	15.1
9-Jul-01	78.8	68.2	59.8	26.0	20.1	15.5
10-Jul-01	74.9	67.9	60.5	23.9	20.0	15.8
11-Jul-01	73.7	67.1	63.0	23.2	19.5	17.2
12-Jul-01	77.5	68.0	61.1	25.3	20.0	16.2
13-Jul-01	77.5	67.9	61.1	25.3	19.9	16.2
14-Jul-01	74.9	65.8	58.6	23.9	18.8	14.8
15-Jul-01	69.9	63.8	58.6	21.1	17.7	14.8

		Fahrenheit			Celsius	
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
16-Jul-01	63.6	60.6	58.6	17.6	15.9	14.8
17-Jul-01	64.3	58.8	54.8	17.9	14.9	12.7
18-Jul-01	67.4	60.0	54.1	19.7	15.5	12.3
19-Jul-01	71.2	62.1	54.8	21.8	16.7	12.7
20-Jul-01	66.8	62.8	58.6	19.3	17.1	14.8
21-Jul-01	70.5	62.3	56.0	21.4	16.8	13.4
22-Jul-01	73.0	63.9	57.3	22.8	17.7	14.1
23-Jul-01	74.9	65.1	58.0	23.9	18.4	14.4
24-Jul-01	74.3	65.6	59.2	23.5	18.7	15.1
25-Jul-01	73.7	64.9	58.0	23.2	18.3	14.4
26-Jul-01	74.3	64.7	58.0	23.5	18.1	14.4
27-Jul-01	73.0	64.0	57.3	22.8	17.8	14.1
28-Jul-01	66.8	61.8	59.2	19.3	16.5	15.1
29-Jul-01	61.7	58.6	55.4	16.5	14.8	13.0
30-Jul-01	62.4	58.6	56.0	16.9	14.8	13.4
31-Jul-01	69.9	61.5	56.0	21.1	16.4	13.4
1-Aug-01	69.9	62.4	56.0	21.1	16.9	13.4
2-Aug-01	73.7	64.5	58.0	23.2	18.1	14.4
3-Aug-01	73.7	64.7	58.0	23.2	18.1	14.4
4-Aug-01	66.8	62.7	59.2	19.3	17.1	15.1
5-Aug-01	73.0	63.5	56.7	22.8	17.5	13.7
6-Aug-01	74.9	66.0	59.2	23.9	18.9	15.1
7-Aug-01	74.9	66.5	60.5	23.9	19.2	15.8
8-Aug-01	73.7	65.2	59.2	23.2	18.5	15.1
9-Aug-01	73.0	64.6	58.0	22.8	18.1	14.4
10-Aug-01	74.9	65.6	59.2	23.9	18.7	15.1
11-Aug-01	74.9	66.3	60.5	23.9	19.0	15.8
12-Aug-01	74.3	67.0	61.1	23.5	19.4	16.2
13-Aug-01	74.9	68.2	63.6	23.9	20.1	17.6
14-Aug-01	75.6	67.7	61.7	24.2	19.8	16.5
15-Aug-01	74.9	67.3	61.1	23.9	19.6	16.2
16-Aug-01	74.9	67.1	60.5	23.9	19.5	15.8
17-Aug-01	71.8	66.0	61.1	22.1	18.9	16.2
18-Aug-01	68.6	62.5	58.6	20.4	17.0	14.8
19-Aug-01	67.4	60.4	55.4	19.7	15.8	13.0
20-Aug-01	68.0	59.4	53.5	20.0	15.2	11.9
21-Aug-01	66.8	60.0	54.8	19.3	15.5	12.7
22-Aug-01	68.6	62.7	58.6	20.4	17.0	14.8
23-Aug-01	63.6	60.8	58.6	17.6	16.0	14.8
24-Aug-01	65.5	59.2	54.1	18.6	15.1	12.3
25-Aug-01	66.8	58.9	52.9	19.3	14.9	11.6
26-Aug-01	68.6	60.7	54.8	20.4	15.9	12.7
27-Aug-01	69.3	61.9	56.7	20.7	16.6	13.7
28-Aug-01	68.0	61.2	56.0	20.0	16.2	13.4
29-Aug-01	68.6	61.5	56.0	20.4	16.4	13.4
30-Aug-01	69.3	62.2	57.3	20.7	16.8	14.1
31-Aug-01	68.0	61.7	58.0	20.0	16.5	14.4
1-Sep-01	65.5	61.2	57.3	18.6	16.2	14.1

		Fahrenheit			Celsius	
Date	Maximum	Average	Minimum	Maximum	Average	Minimum
2-Sep-01	66.8	60.3	55.4	19.3	15.7	13.0
3-Sep-01	65.5	59.8	55.4	18.6	15.4	13.0
4-Sep-01	66.1	59.4	54.1	19.0	15.2	12.3
5-Sep-01	59.8	57.3	55.4	15.5	14.1	13.0
6-Sep-01	59.8	55.1	50.9	15.5	12.8	10.5
7-Sep-01	59.8	54.9	51.6	15.5	12.7	10.9
8-Sep-01	59.8	53.2	48.3	15.5	11.8	9.1
9-Sep-01	61.7	54.8	50.3	16.5	12.7	10.2
10-Sep-01	62.4	55.9	50.9	16.9	13.3	10.5
11-Sep-01	63.0	56.9	52.2	17.2	13.8	11.2
12-Sep-01	63.6	58.2	54.1	17.6	14.5	12.3
13-Sep-01	64.9	59.4	55.4	18.3	15.2	13.0
14-Sep-01	65.5	59.3	55.4	18.6	15.2	13.0
15-Sep-01	64.3	59.3	55.4	17.9	15.2	13.0
16-Sep-01	66.8	61.3	58.0	19.3	16.3	14.4
17-Sep-01	63.6	59.2	56.0	17.6	15.1	13.4
18-Sep-01	60.5	56.7	52.9	15.8	13.7	11.6
19-Sep-01	58.6	55.5	53.5	14.8	13.1	11.9
20-Sep-01	59.2	53.1	49.0	15.1	11.7	9.4
21-Sep-01	58.6	53.8	50.3	14.8	12.1	10.2
22-Sep-01	61.1	55.1	50.9	16.2	12.9	10.5
23-Sep-01	61.7	56.4	52.2	16.5	13.5	11.2
24-Sep-01	62.4	57.2	53.5	16.9	14.0	11.9
25-Sep-01	59.2	56.6	54.1	15.1	13.7	12.3
26-Sep-01	59.8	57.0	53.5	15.5	13.9	11.9
27-Sep-01	58.6	55.9	54.1	14.8	13.3	12.3
28-Sep-01	57.3	54.2	51.6	14.1	12.3	10.9
29-Sep-01	56.0	51.1	47.7	13.4	10.6	8.7
30-Sep-01	56.7	51.8	48.3	13.7	11.0	9.1
1-Oct-01	57.3	52.4	49.0	14.1	11.3	9.4
2-Oct-01	56.0	52.4	49.7	13.4	11.3	9.8
3-Oct-01	54.8	50.8	47.7	12.7	10.4	8.7
4-Oct-01	52.2	48.8	46.4	11.2	9.3	8.0
5-Oct-01	50.9	46.7	43.7	10.5	8.1	6.5
6-Oct-01	52.9	47.8	43.7	11.6	8.8	6.5

Figure A-6: Maximum, minimum and average stream temperatures for the Little Walla Walla Diversion.



File Name: Little Walla2 Diversion – 2001.xls

Table A-6: Water temperature data for the Little Walla Walla Diversion for June 26 through October 8, 2001.

DATE	Fahrenheit Maximum	Fahrenheit Average	Fahrenheit Minimum	Celsius Maximum	Celsius Average	Celsius Minimum
26-Jun-01	61.7	57.1	53.8	16.5	13.9	12.1
27-Jun-01	60.3	56.8	54.7	15.7	13.8	12.6
28-Jun-01	61.9	57.7	54.3	16.6	14.3	12.4
29-Jun-01	65.1	58.9	53.6	18.4	14.9	12.0
30-Jun-01	66.4	60.5	55.9	19.1	15.9	13.3
1-Jul-01	66.4	60.8	55.4	19.1	16.0	13.0
2-Jul-01	66.9	60.8	55.2	19.4	16.0	12.9
3-Jul-01	67.8	61.5	55.9	19.9	16.4	13.3
4-Jul-01	68.9	63.2	58.3	20.5	17.3	14.6
5-Jul-01	66.0	62.0	58.8	18.9	16.7	14.9
6-Jul-01	66.6	60.4	55.9	19.2	15.8	13.3
7-Jul-01	66.9	60.7	55.4	19.4	16.0	13.0
8-Jul-01	68.5	62.2	56.8	20.3	16.8	13.8
9-Jul-01	68.5	62.8	57.2	20.3	17.1	14.0
10-Jul-01	67.8	62.5	58.1	19.9	17.0	14.5
11-Jul-01	66.0	61.2	57.7	18.9	16.2	14.3
12-Jul-01	69.8	62.6	57.6	21.0	17.0	14.2
13-Jul-01	68.5	62.4	57.0	20.3	16.9	13.9
14-Jul-01	67.8	61.8	56.8	19.9	16.6	13.8
15-Jul-01	65.8	60.8	56.5	18.8	16.0	13.6
16-Jul-01	63.9	58.9	55.9	17.7	15.0	13.3
17-Jul-01	59.4	56.9	54.7	15.2	13.8	12.6
18-Jul-01	61.3	57.2	53.8	16.3	14.0	12.1
19-Jul-01	64.9	59.1	53.8	18.3	15.1	12.1
20-Jul-01	60.8	58.7	56.5	16.0	14.9	13.6
21-Jul-01	63.0	58.4	54.3	17.2	14.7	12.4
22-Jul-01	66.6	60.2	55.2	19.2	15.7	12.9
23-Jul-01	67.8	61.4	56.3	19.9	16.3	13.5
24-Jul-01	68.4	62.0	57.0	20.2	16.7	13.9
25-Jul-01	67.8	61.6	56.8	19.9	16.4	13.8
26-Jul-01	67.8	61.4	56.5	19.9	16.4	13.6
27-Jul-01	67.1	61.0	55.8	19.5	16.1	13.2
28-Jul-01	63.9	59.6	56.8	17.7	15.4	13.8
29-Jul-01	57.6	55.9	54.1	14.2	13.3	12.3
30-Jul-01	58.3	55.5	53.8	14.6	13.1	12.1
31-Jul-01	64.6	58.2	53.6	18.1	14.6	12.0
1-Aug-01	63.9	58.8	54.7	17.7	14.9	12.6
2-Aug-01	66.9	60.6	55.8	19.4	15.9	13.2
3-Aug-01	67.1	61.3	56.5	19.5	16.3	13.6
4-Aug-01	61.2	58.9	57.0	16.2	14.9	13.9
5-Aug-01	66.4	59.9	54.7	19.1	15.5	12.6
6-Aug-01	68.0	61.8	57.0	20.0	16.6	13.9
7-Aug-01	68.4	62.4	57.7	20.2	16.9	14.3
8-Aug-01	67.5	61.7	57.0	19.7	16.5	13.9
9-Aug-01	66.9	61.0	56.5	19.4	16.1	13.6

		Fahrenheit			Celsius	
DATE	Maximum	Average	Minimum	Maximum	Average	Minimum
10-Aug-01	68.4	61.9	57.0	20.2	16.6	13.9
11-Aug-01	67.8	62.1	57.6	19.9	16.7	14.2
12-Aug-01	67.5	62.0	57.7	19.7	16.7	14.3
13-Aug-01	66.9	62.3	58.8	19.4	16.8	14.9
14-Aug-01	68.4	62.7	58.3	20.2	17.1	14.6
15-Aug-01	68.4	62.8	58.3	20.2	17.1	14.6
16-Aug-01	67.8	62.4	58.1	19.9	16.9	14.5
17-Aug-01	67.1	61.9	57.7	19.5	16.6	14.3
18-Aug-01	65.5	60.4	56.5	18.6	15.8	13.6
19-Aug-01	64.6	59.0	54.9	18.1	15.0	12.7
20-Aug-01	64.6	58.4	53.6	18.1	14.7	12.0
21-Aug-01	63.9	58.6	54.1	17.7	14.8	12.3
22-Aug-01	64.0	59.4	56.3	17.8	15.2	13.5
23-Aug-01	59.9	57.9	56.3	15.5	14.4	13.5
24-Aug-01	63.3	58.0	54.1	17.4	14.4	12.3
25-Aug-01	63.5	57.7	53.2	17.5	14.3	11.8
26-Aug-01	64.0	58.6	54.1	17.8	14.8	12.3
27-Aug-01	65.8	59.8	55.8	18.8	15.4	13.2
28-Aug-01	64.4	59.0	55.2	18.0	15.0	12.9
29-Aug-01	65.1	59.5	55.2	18.4	15.3	12.9
30-Aug-01	65.8	60.0	55.9	18.8	15.6	13.3
31-Aug-01	64.6	59.4	56.3	18.1	15.2	13.5
1-Sep-01	62.8	58.6	55.4	17.1	14.8	13.0
2-Sep-01	63.5	58.4	54.3	17.5	14.7	12.4
3-Sep-01	63.5	58.3	54.7	17.5	14.6	12.6
4-Sep-01	63.5	58.0	53.8	17.5	14.5	12.1
5-Sep-01	59.7	56.1	53.6	15.4	13.4	12.0
6-Sep-01	59.9	55.3	52.0	15.5	12.9	11.1
7-Sep-01	58.8	54.9	52.0	14.9	12.7	11.1
8-Sep-01	59.4	54.2	50.2	15.2	12.3	10.1
9-Sep-01	60.3	55.1	51.4	15.7	12.9	10.8
10-Sep-01	60.8	55.7	52.0	16.0	13.2	11.1
11-Sep-01	60.8	56.0	52.2	16.0	13.3	11.2
12-Sep-01	61.3	56.7	53.2	16.3	13.7	11.8
13-Sep-01	60.6	56.8	54.3	15.9	13.8	12.4
14-Sep-01	62.4	57.6	54.1	16.9	14.2	12.3
15-Sep-01	62.2	57.5	54.1	16.8	14.2	12.3
16-Sep-01	62.8	58.3	55.4	17.1	14.6	13.0
17-Sep-01	61.3	57.2	54.1	16.3	14.0	12.3
18-Sep-01	60.3	55.9	52.5	15.7	13.3	11.4
19-Sep-01	58.8	54.9	52.2	14.9	12.7	11.2
20-Sep-01	58.3	53.9	50.4	14.6	12.2	10.2
21-Sep-01	57.6	53.8	51.1	14.2	12.1	10.6
22-Sep-01	59.4	54.7	51.4	15.2	12.6	10.8
23-Sep-01	58.3	54.7	51.4	14.6	12.6	10.8
24-Sep-01	59.2	55.6	52.7	15.1	13.1	11.5
25-Sep-01	57.2	54.6	52.2	14.0	12.6	11.2
26-Sep-01	56.5	54.4	52.5	13.6	12.4	11.4

		Fahrenheit			Celsius	
DATE	**Maximum**	**Average**	**Minimum**	**Maximum**	**Average**	**Minimum**
27-Sep-01	55.9	53.9	52.5	13.3	12.2	11.4
28-Sep-01	57.0	53.5	51.4	13.9	12.0	10.8
29-Sep-01	55.9	52.1	49.3	13.3	11.2	9.6
30-Sep-01	55.9	52.1	49.1	13.3	11.2	9.5
1-Oct-01	57.0	52.8	49.6	13.9	11.5	9.8
2-Oct-01	55.8	52.7	50.4	13.2	11.5	10.2
3-Oct-01	55.2	51.7	49.3	12.9	11.0	9.6
4-Oct-01	53.6	50.4	48.0	12.0	10.2	8.9
5-Oct-01	52.2	49.0	46.0	11.2	9.4	7.8
6-Oct-01	53.2	49.6	46.9	11.8	9.8	8.3
7-Oct-01	51.4	49.4	47.7	10.8	9.7	8.7
8-Oct-01	53.1	50.3	48.7	11.7	10.2	9.3